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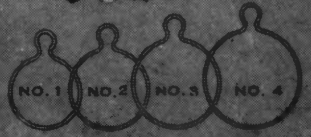

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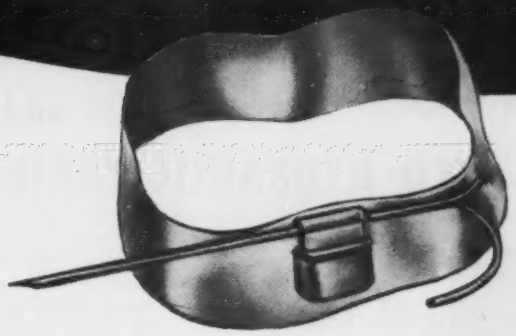

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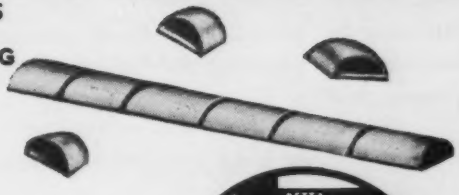

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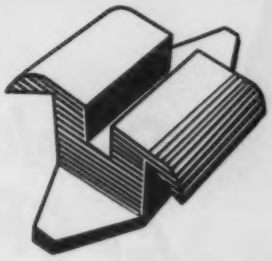

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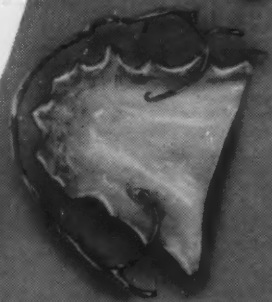

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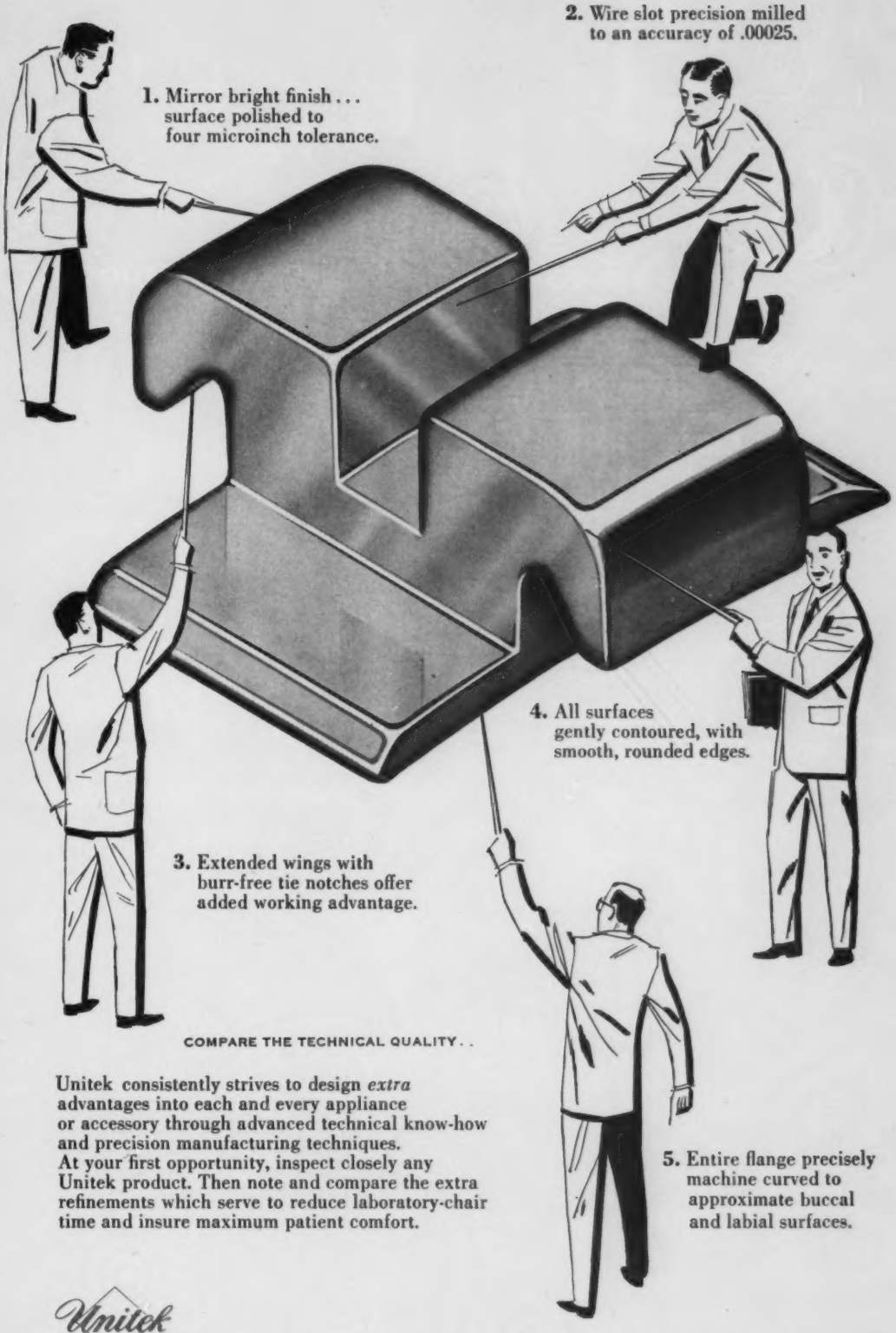

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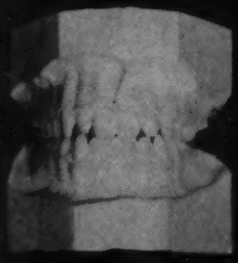

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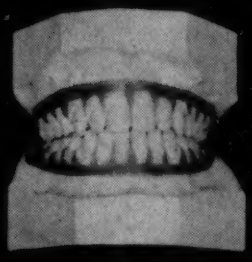

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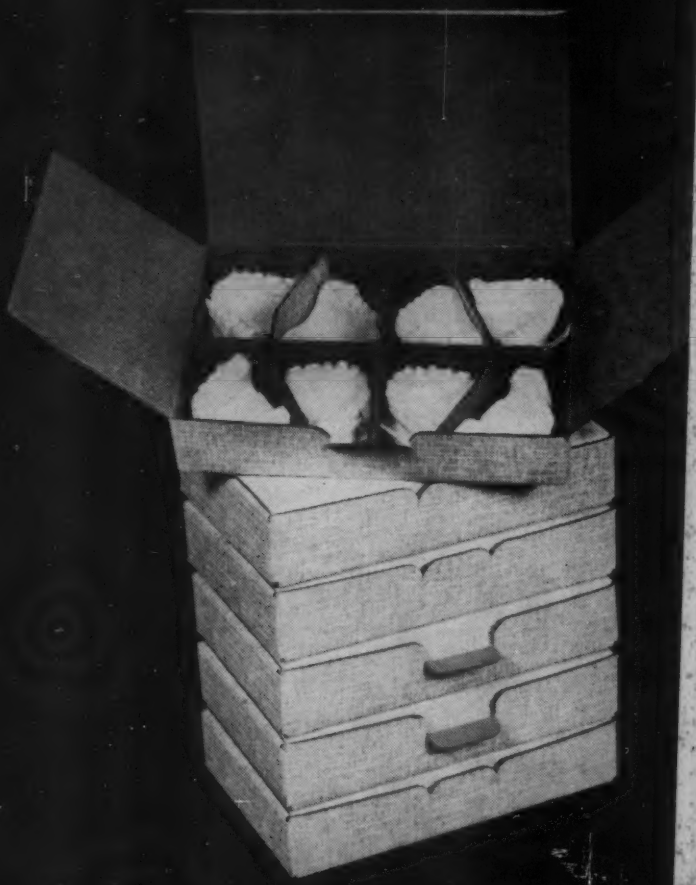

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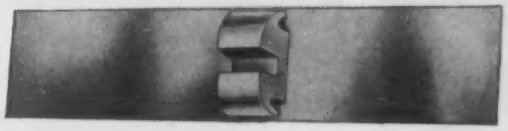

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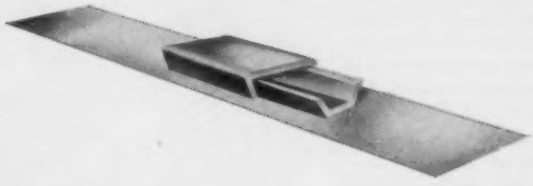

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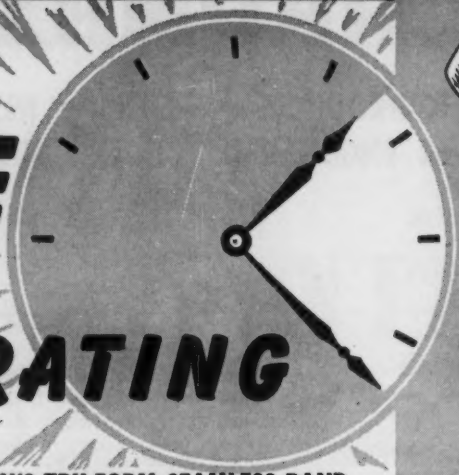

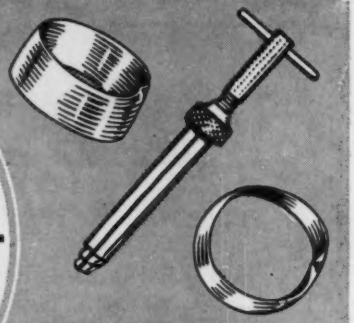

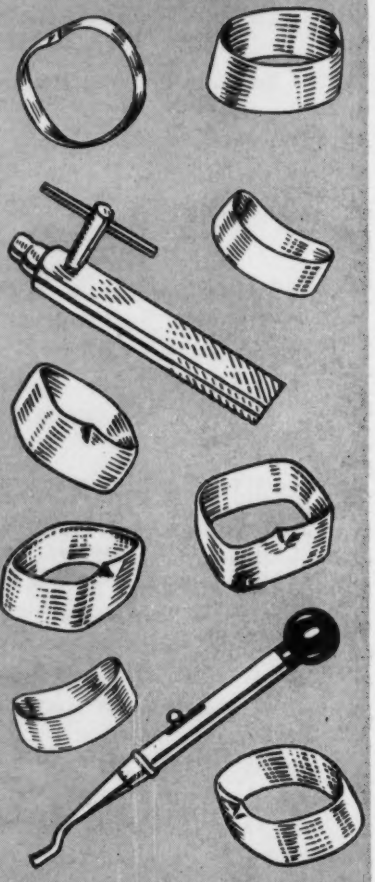

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American Journal

of

ORTHODONTICS

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Original Articles

PRESIDENT'S ADDRESS, SOUTHWESTERN SOCIETY OF ORTHODONTISTS

J. VICTOR BENTON, D.D.S., WICHITA, KANSAS

IT IS an honor and a privilege to welcome you to Wichita and to the thirty-fifth annual session of the Southwestern Society of Orthodontists. It is also an honor to have been associated with those men in this Society who have already served as its president. As most of you know, the circumstances surrounding my appointment as your president-elect last year were most unusual. Some of you also know that it was with a great deal of hesitancy that I accepted the appointment, knowing that it meant serving as your president this year. It was accepted very humbly and in complete knowledge that it was something which I had not yet earned, and for which I felt unprepared. The confidence represented by this appointment and your willingness to entrust me with this position of responsibility in your Society are memories that I shall always cherish with warm and deep appreciation.

There is but one feeling of regret, and that is that this privilege could not have come later in my life and that my good friend and professional partner. Dr. Wm. M. Pugh, whose presidency I assumed, could not have this year enjoyed the honor which he so nobly deserved. The many years of faithful service and devotion to the art and science of orthodontics by men like Bill Pugh are now serving as steppingstones to carry our profession ever onward, and they will continue to do so for years to come.

Presented at the thirty-fifth annual meeting of the Southwestern Society of Orthodontists, Wichita, Kansas, Oct. 17, 1955.

The Southwestern Society of Orthodontists is an organization of which we can all be proud; yet we should also be humble in the knowledge that it was those of its membership who pioneered and worked so hard who have advanced this profession to its current high place as a specialized field. A debt of gratitude is due those men whose initiative and foresight have been responsible for this wonderful organization, its accomplishments, and its contributions to society as a whole. Those men who were the founders of the Southwestern Society and who are still with us are held in eminent esteem by its younger members. The pattern of high ideals has been set; that pattern must be adhered to with enduring faith and sincerity of purpose. We may well be proud of this Society and grateful for the privilege of membership—grateful also for the privilege of serving it and for participation in meetings such as this, the programs of which have been of extremely high caliber and expedience.

Throughout the years the scientific programs have contributed greatly to the progress and growth of the Southwestern Society as an organization and to the professional development of its individual members. The essayists and clinicians must be given credit for the major part which they have played. It has also been the purpose of these meetings to promote among the membership a wholesome fraternal relationship, not for personal gain, but as a means of uniting their ideas, efforts, and capabilities to the best interests of the organization as a whole and fostering the advancement of orthodontics in a spirit of friendship and cooperation.

It is my happy privilege to welcome officially those elected to membership in the Southwestern Society at the last annual meeting, as well as those whose applications are to be voted on at this meeting. It is my hope that membership in the Southwestern Society will be more than a realization of your expectations, and that your association with those men who have contributed so much to orthodontics will stimulate you to share with them the task of carrying your chosen profession to new horizons and unscaled heights.

It is the duty of the president to review some of the activities of the Society. To make recommendations, and to comment upon the problems of the Southwestern Society and of the American Association of Orthodontists. You will hear reports of the various committees and their accomplishments of the past year. The excellent cooperation and untiring efforts of those men on the board of directors and on our appointed committees have made it possible for your Society to progress. Serving as your president for the past year has been an enjoyable experience—made so by your unfailing and wholehearted cooperation. Each and every committee chairman and member accepted appointment with enthusiasm and interest. The Program Committee, under the chairmanship of Tom Williams, has evidenced eager and efficient teamwork in obtaining our excellent essayists, and I share with you great pride in this achievement. We know that a very interesting and helpful program is in store for us.

Before proceeding further, I wish to express my very sincere and deep gratitude to Harold Born, our Society's secretary, for the prompt and efficient manner in which he has executed the duties of this office. He has truly been a

"pen pal" of the highest order during the past year, and I am most grateful. I also wish to express my appreciation to: (1) my board of directors, (2) all the committees, and especially (3) the Local Arrangements Committee of which John Rogers served as chairman, (4) the members of the Wichita Dental Society and their wives who have assisted the Local Arrangements Committee, (5) the Wichita orthodontists and their wives, (6) all those who have prepared table clinics and this committee under the chairmanship of Howard Dukes, (7) chairmen and members of the newly appointed committees, and (8) my private secretary, Miss McKillip. Again, thanks to all the committees and to our efficient secretary, Harold Born.

There are a few recommendations which I wish to offer to the Society for definite action. As you know, for the past year we have been in the process of organizing new committees and defining their duties. It is my feeling that during the coming year the efforts of our leaders should be devoted largely to activating these new committees, rather than undertaking too many added projects. There are, however, certain problems affecting our Society which demand our attention at this time and to which we should give serious consideration:

1. I should like to recommend to the Economics Committee and its capable chairman, Harry Sorrels, that a study be made of the various economic problems involved in practicing orthodontics. Among these are business management, fee schedules, ethics, advantages and disadvantages of group and individual practice, personal insurance and investment programs, and many others. In addition to these problems, which should be of interest to all of those in the profession, there is another matter of vital concern to those young men just entering the field of orthodontics. To them their first major decision following completion of their formal training is that of choosing a location. As a factor in the success or failure of a promising young orthodontist, this often ranks next to professional ability and personality. Certainly, many able and personable professional men have been thwarted by unsuitable locations or have built successful practices only after making second or third—and wiser—choices. There are many economic problems confronting the orthodontist—old, young, or in between—which could be made less perplexing for these men by the availability of information compiled by a committee and based on current findings.

2. I should like also to recommend that the secretary-treasurer of the Society serve as an ex officio member of the Budget and Auditing Committee. Inasmuch as he is familiar with current demands on the funds and also with pending expenditures, he would be able to lend valuable assistance to this committee.

3. I should like to recommend that the Budget and Auditing Committee designate an amount of money to be appropriated for the fostering of orthodontic research. If such an appropriation is not possible from available funds, I further recommend that an annual assessment

be levied upon each member of the Society, proceeds of which would be turned over to the chairman of the Research Committee for use in a research project.

4. I should like to recommend the formation of study groups in all the states in the geographical area of the Southwestern Society. The reorganization of the Society's committees has been undertaken in an attempt to utilize more fully the vast resources of ideas and talent among its members, which have been untouched because heretofore the administration of Society affairs has been placed largely in the hands of a comparative few. In the early years of the organization this was undoubtedly wise. In view of its growth, however, the committee reorganization referred to certainly has merit. Likewise, in view of the growth, progress, and increased membership of the Society, I feel that state study clubs could now become an integral part of an expanding organization. In these smaller groups many problems could be studied, and solutions reached, which would be impossible in the Society as a whole. In addition, the experiences and ideas of all members of the Society could be brought to light and utilized more fully, with resulting benefits to all concerned. At this point, those of you from Oklahoma are privileged to beam with pride, and you from Kansas are justified in joining me in hanging our heads. I wish to congratulate the Oklahoma members on their fine study group and to urge the other states to follow their example.

5. I recommend that a historian be appointed by the board of directors to abstract data from which all members could acquaint themselves with the accomplishments of their sectional societies. It should also be the duty of the historian to record and maintain a complete professional history of each member of the Society.

6. I should like to recommend that the Nomenclature Committee take decisive steps to cooperate with the American Association of Orthodontists and the Bureau of Library and Indexing Service of the American Dental Association in their efforts to bring about a standardization of orthodontic nomenclature. I feel that similar action on the part of the sectional societies will be necessary before orthodontics can achieve a nomenclature properly integrated with dentistry as a whole. It does seem ironic that the American Association of Orthodontics has no official nomenclature, in spite of the fact that it has been in existence for more than fifty years. This is undoubtedly due to the fact that it is such a large project and one which cannot be accomplished without the wholehearted cooperation of the sectional societies. I certainly hope that the Southwestern Society will lead in taking steps toward standardization of orthodontic nomenclature in compliance with rules of recognized language authorities.

In these remarks I hope that you have followed with me as we have looked briefly into the *past*, paying tribute to those who have gone before; as we have

paused in appreciation of those who are our *present* bulwark of strength; and as some of my aspirations for the *future* of the Society have been revealed. We hope that the Wichita meeting, as all others in the past, will renew for each and every member not only his friendships, but also his interests in his Society, in his profession, and in himself, and cause him to return home with renewed enthusiasm for the dedication of his life to the advancement of orthodontics. Thank you.

THE MANAGEMENT OF ORTHODONTIC PRACTICE

ALEXANDER SVED, D.D.S., NEW YORK, N. Y.

THE keeping of orthodontic records becomes an involved problem in successful practices. A successful practice may develop from a modest beginning, and it may take on very large proportions as a result of honest, sincere, and unselfish service. It is inevitable that a well-conducted practice becomes larger in time, for our responsibility to the patient does not cease with the removal of the active appliances. In each successive year the number of cases attached to the office becomes larger and, unless it is recognized well in advance and provisions are made to prevent it, the practice becomes saturated and the quality of service deteriorates. A saturation point may be reached by the inability of the orthodontist to complete the cases under treatment within the estimated time or it may be the result of poor management, permitting all patients to arrive at the office after school hours for every appointment. Under such conditions, there is not enough time to make the necessary changes in the appliances, and treatment of the cases will be unduly prolonged. As the practice becomes larger, the unfinished cases become so numerous that new patients cannot be accepted without the further deterioration of service and an intensified crowding during the after-school hours. This may lead to the premature conclusion of the cases under treatment, with the very great possibility of a relapse. Eventually, such cases must be retreated, thus placing a greater hardship on the practice in the future.

When we analyze the factors entering into this problem, we must arrive at the conclusion that it is physically impossible to conduct an orthodontic practice after school hours. In a large city it is not possible for a child to arrive at the office before 3:30 in the afternoon; and, since the last appointment cannot be made later than 5:30, there are only two hours during which appointments can be arranged. With the modern orthodontic appliances, a minimum of thirty minutes is required for each patient at every visit, so that the maximum number of patients that can be treated on any afternoon is not more than four. This does not allow time for recementing bands or for changes in the appliances and other repairs. Even under the best of conditions, it would not be possible to leave the office before 6 or 6:15 P.M. If repairs must be made for one or two patients, we would not be finished with the afternoon's work before 7 o'clock. Those who insist on after-school appointments must realize that we cannot compete with the commercial houses having office hours from 9 to 5 and that it is most difficult to find assistants who are

Read before the Rocky Mountain Society of Orthodontists, Denver, Colorado, October, 1955.

willing to work such late hours. In my practice the last appointment is made at 4 o'clock in the afternoon, and we make every effort to finish at 5 o'clock whenever possible. Even with this arrangement, however, it is not uncommon that we must work until 5:30 or later. It is to be considered that neither the parents nor the school authorities understand our problems, and unwittingly they place extreme hardships upon us and, in effect, try to run our practices. It is our duty, therefore, to enlighten them and explain to them in detail that the limitations thus imposed are not to the best interests of the children. They would make it impossible to render proper service and would enhance the occurrence of decay under bands, which would not be removed and recemented on account of insufficient time. This is a responsibility which I cannot accept; I insist on the right to run my own practice.

In a large practice, the keeping of records is extremely important. Unless care is taken, several patients may not receive treatment for many months and

PATIENT'S NAME _____ DATE _____

FATHER'S NAME _____ DATE OF BIRTH _____

MOTHER'S NAME _____

BUSINESS ADDRESS _____ TELEPHONE _____

RESIDENCE _____ TELEPHONE _____

REFERENCE _____ ADDRESS _____

SCHOOL _____ HOURS _____

CONSULTATION FEE $10.

Fig. 1.

the cases under retention may relapse if not properly guided and advised during the retention period. To fully appreciate what is involved, I shall describe the system I use in my office, which was developed in response to the demands created by a rapidly growing practice. In the beginning, I used the conventional history charts and appointment books, which served me sufficiently well until it became clear that certain changes had to be made. These changes were made at different times, and as often as they became necessary. The system to be described can be adapted to the largest practice without any difficulty.

When a patient comes to the office for consultation, the parents are requested to fill out a card similar to that shown in Fig. 1. This is printed on white paper and we refer to it as the "white card." In this way we obtain the preliminary information regarding the patient, such as name, date of birth, father's name, mother's name, business address and telephone number, home

address and telephone number, and references. At the bottom of the card there is the printed information that the consultation fee is $10.00. This was suggested originally by Dr. George M. Anderson, who used a similar card for new patients, with the difference that the amount of the consultation fee was not given. It was subsequently filled in by hand and the amount varied with the requirements of the case, such as models and x-ray pictures. I consider the $10.00 a basic consultation fee without x-rays or models. Whenever they become necessary, a separate charge is made. This is one of the most useful devices in my practice. Every new patient knows that there is a consultation fee and it is never questioned. We do not attempt to collect the fee at the conclusion of the consultation. If it is offered by the patient, it is accepted by the secretary; otherwise, a statement is sent out on the first of the following month. There is no difficulty in the collection of the consultation fee and the response to the statements is nearly 100 per cent. There is something convincing in advising the patient in this manner that there is a consultation fee. If we would do the same thing through the secretary the whole procedure would appear to be mercenary, and I hesitate to do so for fear that many patients would be offended. I have been using these cards for more than ten years without the slightest criticism on the part of the patients.

In the majority of cases, it is possible to advise the patient at the first visit as to whether treatment is indicated and the length of time the active work requires. On that basis, it is possible to arrive at a definite fee. Before the fee is discussed, however, it is explained to the parent that the child will be taken out of school for every appointment. There is a good deal of opposition to this, and if it cannot be arranged the child will not be accepted for treatment. It is further pointed out to the parents that, inasmuch as they are about to spend a considerable sum of money, it is important that the child receive the best attention which can be given. If they all come in after school hours this cannot be done. When the parents realize that treatments are given only once a month, we usually come to an understanding. This must be discussed before the patient is accepted for treatment, for it is most difficult to make such arrangements after the appliances are made. The fee is discussed only after the problem of appointments is disposed of. It is based on the estimated length of treatment. The appliance fees are the same for all cases which include the active appliances and retainers. The only difference between a simple case and a difficult case is the length of time required to bring about correction. The monthly payments are made during the estimated length of treatment and it is agreed that if the case is not completed within that period no further monthly charge will be made. If, on the other hand, the case is completed before the estimated time, the fee remains the same, and even after the appliances are removed the monthly payments are continued until the full amount of the fee is paid. This is a very equitable arrangement and, if properly presented, it is always accepted without comment. Incidentally, it may be stated that very few cases are carried beyond the estimated

time and, inasmuch as time is always available to do whatever is necessary, the cases are brought to completion in twenty to thirty adjustments. There are very few nonpaying cases to hinder the practice.

The fee quoted to the patient is marked on the back of the white card and, if the terms are acceptable, an appointment is made for impressions and x-rays and also for construction of the appliances. These two dates are also recorded on the back of the white card and entered in the proper place in the appointment book. All white cards are given to the secretary, who makes out a small

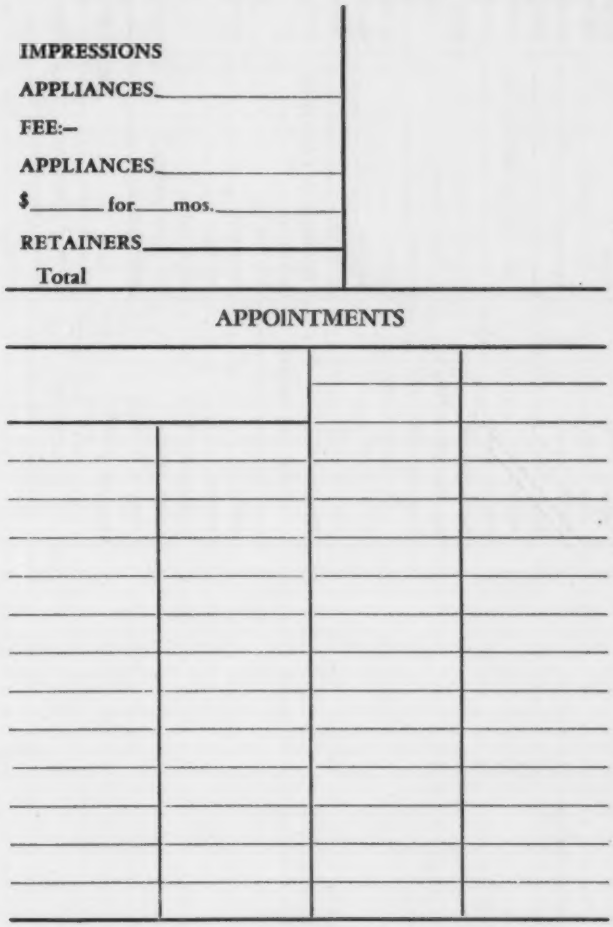


Fig. 2.

financial card for the consultation fee and files away the white cards. For those patients who have made definite arrangements, a salmon-colored card is made out, to which the information given on the white card is transferred. These salmon-colored cards are filed away in the active file, which differs from the white card file in that it contains records of only those patients who receive active treatment or who are under retention or observation. On the back of these cards (Fig. 2) is a space for rubber stamps, which classify the patients as "active," "retention," and "observation" cases. When an observation

CONSULTATION NO. NAME CASE NO.

REFERRED BY ADDRESS TELEPHONE DATE

HISTORY OF PATIENT	DURATION	AGE 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
WHOOPING COUGH		
MEASLES		
GERMAN MEASLES		
Diphtheria		
SCARLET FEVER		
CHICKENPOX		
SMALLPOX		
TYPHOID		
MALARIA		
INFLUENZA		
DYSENTERY		
RHEUMATIC FEVER		
MUMPS		
TUBERCULOSIS		
SYPHILIS		
POLIOMYELITIS		
DIABETES		
ACIDOSIS		
HEART DISEASE		
CHLOROSIS		
ANEMIA		
ADENITIS		
THYROID		
PITUITARY		
NEPHRITIS		
NERVOUS DISORDERS		
ASTHMA		
BRONCHITIS		
HAY FEVER		
PNEUMONIA		
Pleurisy		

GENERAL INFORMATION	
BIRTH { NORMAL / INSTRUMENT	
FEEDING { BREAST / BOTTLE	
PACIFIERS	
MISSING TEETH	
IMPACTED TEETH	
MALFORMED TEETH	
SUPERNUMERARIES	
RETAINED DECIDUOUS TEETH	
EARLY LOSS OF DEC. TEETH	
LOSS OF PERMANENT TEETH	
WALKED AT AGE OF	
TALKED AT AGE OF	
MENSTRUATION	

NOSE AND THROAT	
TONSILS	
ADENOIDS	
MAXILLARY SINUSITIS	
FRONTAL SINUSITIS	
DEFLECTED SEPTUM	
BREATHING { NASAL / MOUTH	

NUTRITION

HABITS	
SUCKING	
BITING	
PRESSURE	

MUSCLES OF MASTICATION	
INTERNAL PTERYGOID	
EXTERNAL PTERYGOID	
MASSETER	
TEMPORAL	
DIGASTRIC	
MYLOHYOID	

SYMPTOMS OF FEEBLENESS	
FLAT FEET	
KNOCK KNEES	
BOW LEGS	
ROUND BACK	
PROTUBERANT ABDOMEN	
MOIST HANDS	

HISTORY OF MOTHER	
NUMBER OF PREGNANCIES	
NUMBER OF MISCARRIAGES	
FATIGUE	
CONSTIPATION	
VOMITING	

DISEASES DURING PREGNANCY

DUTIES

CALCIFICATION	
NUMBER OF CARPALS	
EPIPHYSIS OF RADIUS	
EPIPHYSIS OF ULNA	
STYLOID PROCESS OF ULNA	
SESAMOID OF THUMB	
UNION OF EP. OF PHALANGES	
UNION OF EP. OF METACARPALS	
UNION OF EP. OF ULNA	
UNION OF EP. OF RADIUS	

OCCLUSION	CLASS I	CLASS II 1	CLASS II 2	CLASS III
PATIENT				
MOTHER				
FATHER				
SISTERS				
BROTHERS				
BLOOD RELATIVES				

Fig. 3.

case is placed under treatment it is stamped "active," and when it is completed it is changed to "retention." This enables anyone to classify the patients, and if a request is made for appointments the right kind of appointment can be made, for there are different kinds of appointments. The retention cases are eventually discharged and then the salmon-colored card is withdrawn from the active file, stamped "closed," and filed away in the closed file. With this system of markings, even if all cards became suddenly mixed up, they could be separated without difficulty. Thus, the white cards contain the records of all patients who have come to the office for consultation, while the salmon-colored cards in the active and closed files contain the records of all patients who have been treated or may later be treated.

When impressions and x-ray pictures are taken, the patient is given a number. These are consecutively entered in a book, together with the name of the patient, and cross reference is made in the same book in the alphabetical index so that it is very easy to determine the name of the patient corresponding to a number, or the number of the model corresponding to a given patient. While this is a satisfactory arrangement, the names under a letter in the alphabetical index cannot be arranged in alphabetical order. Therefore, in addition, a plain card is made out for each patient, showing the number of the models, and this is filed in alphabetical order. The number of the model appears on every record card of the patient.

The history of the patient is taken at the same time as the impressions and x-ray pictures and is recorded on the chart shown in Fig. 3. On the other side of this chart, provision is made for all important entries pertaining to treatment and major changes and also a complete notation of appointments which, in addition, are marked to show those which are canceled or broken. This shows at a glance whether the patient is cooperative, and is very useful when the patient's attitude is discussed with the parents. Two sets of impressions are taken; one set is poured in plaster as a record and the other is made up in stone for the making of molar bands. From these models, a drawing of the arch form is made (Fig. 4) and filed away, together with a band chart (Fig. 5) on which the date on which impressions and models were taken is entered. These band charts are very valuable in determining when a band should be recemented. This information is given by the dates entered in the small boxes under or above each tooth. Molar bands are recemented every six months, while the anterior bands are removed only once a year unless they become loose before that time. The premolar bands usually become loose once or twice a year so that they require very little attention. In the event they do not become loose, however, they also are removed and recemented after twelve or fifteen months. On the band charts provisions are made for recording the hygiene of the patient. At every appointment the patient is given a rating for hygiene. Special mention is made when the teeth are kept very clean; then the patient receives a "good" rating. In case of poor hygiene, the patient's attention is forcefully called to the fact that cavities may develop and he is given a "poor" rating. Whenever a patient's hygiene is marked "poor," a card (Fig. 6) is automatically mailed to the parents and an entry is made

NAME OF PATIENT

October 7, 1953

No. 1555

U=21 M=23 D=16

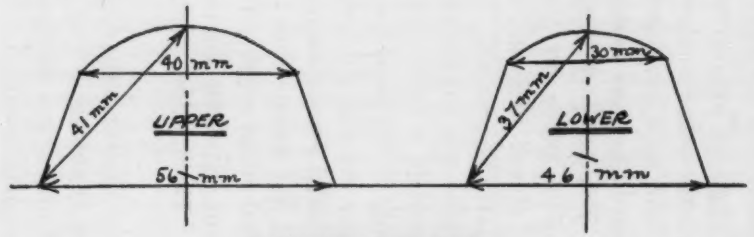
U=16 M=25 D=16

APPLIANCE ADDITIONS { To "U"=.5 mm / To M =.7 mm

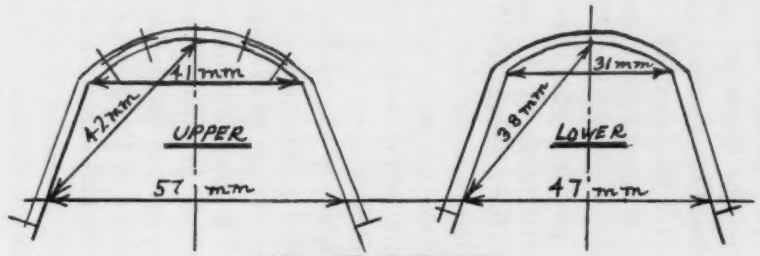
ARCH FORM		
ARCH	ULTIMATE	APPLIANCE
UPPER	W=2U+D-2 =42+16-2 =56mm	W=1+56 =57mm M=23+.7 =23.7mm
LOWER	W=2U+D-2 =32+16-2 =46mm	W=1+46 =47mm M=25+.7 =25.7mm

BUCCAL — UPPER

CURVATURE — LOWER



ULTIMATE ARCH FORM



APPLIANCE ARCH FORM

Fig. 4.

NAME_____ RIGHT LEFT NO._____

												IMPRESSIONS	HYGIENE		REFERRED TO DENTIST
1ST MOLAR	2ND PREMOLAR	1ST PREMOLAR	CANINE	LATERAL	CENTRAL	CENTRAL	LATERAL	CANINE	1ST PREMOLAR	2ND PREMOLAR	1ST MOLAR	RADIOGRAPHS			PARENTS NOTIFIED

REMARKS

												DECALCIFICATION
												RESORPTION
												DEVITALIZATION

January February March April May June
July August September October November December

Fig. 5.

DR. ALEXANDER SVED
654 MADISON AVENUE
NEW YORK

DEAR_____

THIS IS TO INFORM YOU THAT THE TEETH OF_____ ARE NOT SATISFACTORILY CLEANED. AFTER REPEATED INSTRUCTIONS THE CONDITION OF THE MOUTH IS NOT IMPROVED, THEREFORE, I ADVISE THAT THE BRUSHING OF THE TEETH AT HOME BE SUPERVISED. UNLESS THIS IS DONE DECALCIFIED AREAS ON SOME OR ALL TEETH WILL APPEAR, WHICH EVENTUALLY WILL RESULT IN THE FORMATION OF CAVITIES. PLEASE GIVE THIS MATTER YOUR IMMEDIATE ATTENTION.

SINCERELY YOURS,

Fig. 6.

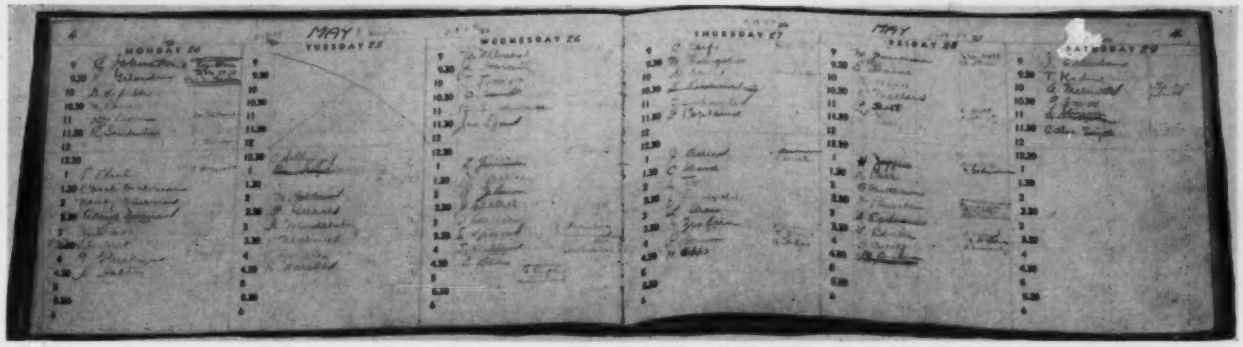


Fig. 7.

in the column indicating that the parents were so advised. In the event that decalcification of the teeth occurs, the parents always recall that their attention was frequently called to the lack of cleanliness. In case of indifference after repeated warnings, the case is discontinued before the decalcified areas break down. If no comment is made, the patient is given a "fair" rating for hygiene. In every instance, the patients are referred to their dentists for half-yearly checkup.

The making of appointments is an extremely important part of the secretary's duties. Unless the status of every patient is known, it is not possible to make the proper appointments. Here, it is intimated that the time required for each class of patients is different, and from past experience we know that patients cannot be given indiscriminate appointments, even though there seems to be plenty of room for the name in the appointment book. The classification of patients in different offices may vary, depending upon the division of work by the orthodontist. In my practice, all appliances are made in one four-hour appointment, and all active cases receive treatment once a month. Accordingly, the patients are classified as impression, appliance, active, retention, and observation cases. The impression cases require thirty to forty minutes for impressions and x-ray pictures, the appliances are made in about four hours, while the active cases are usually given thirty minutes which, on some occasions, may be extended to one or one and one-half hours. The observation and retention cases require but a few minutes. The difficulty arises with the short cases because they are so numerous that they cannot be worked in between the active cases. We carry more than 400 such patients who must be seen at regular intervals. The responsibility of making appointments is a serious one. As a result of indiscriminate appointments, the day may be so overloaded that it would be impossible to make the necessary adjustments and changes in the several appliances. In order to make certain that, as far as humanly possible, sufficient time will be allowed for each patient, it became necessary to devise a system in which time could be found for any kind of appointment and which would make it possible for me to attend important meetings. For this purpose, an appointment book was especially designed and printed (Fig. 7), showing the six working days of the week. Since only one book is needed for each year, in the limited printing it was not possible to print the calendar days; in these appointment books, that is written in by hand, usually a year in advance. While preparing the book for the year, each month is divided into four weeks, designated by the large figures at the right and left upper corners. Inasmuch as there are fifty-two weeks in a year and thirteen weeks in a quarter, there will be one free week in every three months. These free weeks are designated as "zero" weeks and they are so marked in the appointment books. These "zero" weeks may be so arranged that they take in the extended holidays, such as the Christmas and, as nearly as possible, the Easter vacations. This gives us an opportunity to review a large majority of the observation and retention cases so that they present no problems to us so far as the active cases are concerned. There are several retention cases which must be seen more frequently. Provision is made to see them at six-week intervals

at designated times, but in no instance are they allowed to interfere with the active cases. They always create a problem, because they usually arrive at the time when all chairs are occupied by patients requiring long appointments and they cannot understand why they must wait an hour for a five-minute appointment. It is far better to see a large number of such patients on the same day than to try to work them in with the others. The four weeks of the month are divided into two groups. The first and third weeks are reserved for the construction of appliances, taking of impressions, and for those regular patients who cannot be accommodated during the second and fourth weeks, which are reserved exclusively for the treatment of active cases. By this arrangement, a certain flexibility is given to the system and if for any reason I cannot be at the office on a particular day, that day can be cleared without any difficulty

654 MADISON AVE. TE 8-5510

M _____

HAS AN APPOINTMENT WITH

DR. ALEXANDER SVED

ON THE _____ OF EACH MONTH

AT _____ A. M. P. M.

THE EXACT DATES ARE GIVEN ON THE REVERSE SIDE OF THIS CARD. PLEASE DO NOT CHANGE THESE APPOINTMENTS UNLESS IT BECOMES ABSOLUTELY NECESSARY.

Fig. 8.

by transferring the appointments of that day to the same day of the previous or the following week. The book is set up for the entire year in September, after the children return from their summer vacations. We try to maintain the same arrangement of appointments used during the previous year and, with a few exceptions, all appointments are written in the book in the proper places. For example, if a patient is given a 10:30 appointment on the fourth Wednesday of the month, the name of that patient is entered for the 10:30 appointment of the fourth Wednesday of every month until June. The actual dates of the appointments are listed on the reverse side of the yearly appointment card (Fig. 8) which is given to the patient. Inasmuch as our appointments are made far apart, a reminder is mailed to every patient one week before the appointment. If the appointment is not kept, without the patient's advising us, we call the patient on the telephone within one hour after the appointment is broken, and arrange to see him *at our convenience.*

At the time the insertion of the appliance is completed, the patient is given instructions in the use of the toothbrush and appointments are arranged until the end of the school year. Obviously, it is only in rare instances that we can give a desirable appointment to a patient, but inasmuch as that phase has already been disposed of at the very beginning, it usually presents no further complications. Every effort was made to impress the patient of the importance of the appointments, and our reminders are very highly respected.

The band charts are used as guides against prolonged use of bands without recementing. As explained previously, the molar bands must be removed every six months and the anterior bands once a year. The charts tell us that this must be done, but this work is time consuming and it must be so arranged that it is evenly distributed. Using the band charts alone, it may so happen that four or five out of the six morning patients need recementing, which would be too much work for any one morning. This is brought about by the summer vacation, during which time the recementing of bands must be postponed until the fall. This, together with the inevitable repairs, places a very

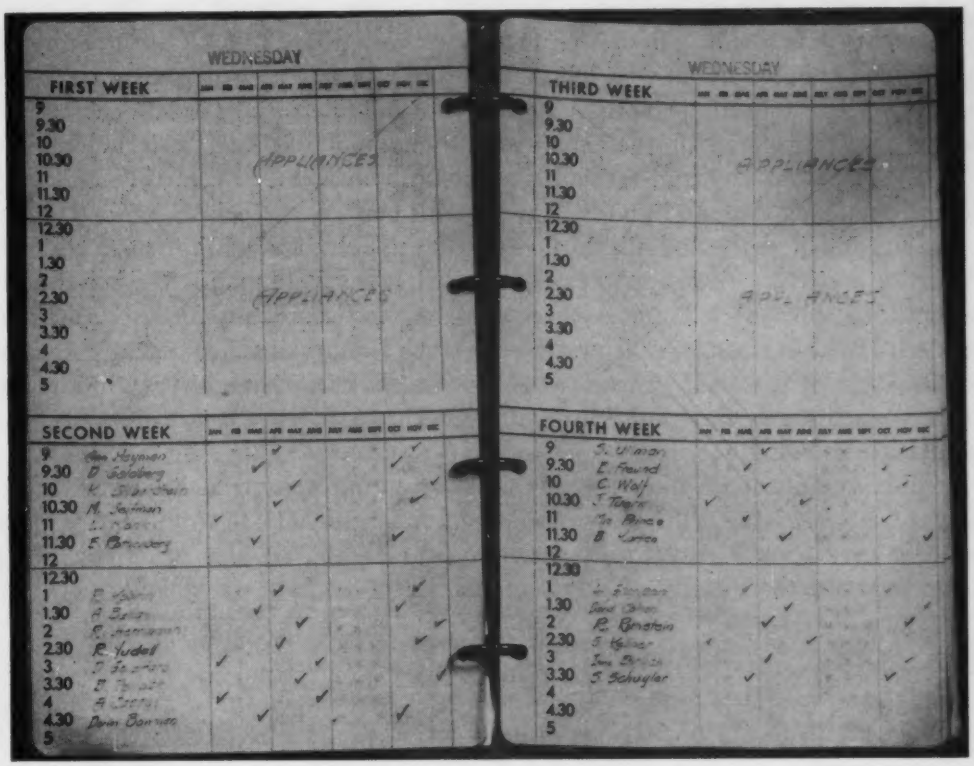


Fig. 9.

heavy burden upon us and, in order to avoid it, a better distribution of recementing is arranged by doing all the recementing after the summer rush is over and all the necessary repairs and changes are made in September. Accordingly, it is realized that during July, August, and September bands cannot be recemented; therefore, the remaining months are divided into two groups of four months each. The first group includes October, November, December, and January, while March, April, May, and June make up the second group. During the month of February no bands are recemented. In order to insure a good distribution, a special work sheet was devised (Fig. 9) on which the patients whose bands are to be recemented are distributed in such a way that no more than two patients have bands removed during the morning, and no more

than two during the afternoon. The dates on which this work is to be done are marked with a red star after the name of the patient in the appointment book, so that at the beginning of the day we know exactly who will have a long appointment. By this arrangement, it becomes possible to distribute the work in a uniform manner and those patients who need recementing will always have it done. The result is that there are no decalcified areas under the bands, except in rare instances, and all the decalcifications around the necks of the teeth are caused by the patient's carelessness which, if sufficiently severe, would be considered a good cause for discontinuing treatment.

There is just one more phase of this system which should be discussed. In the event a patient wishes to find out the time assigned for the next appointment, it is almost impossible to locate the patient's name in the appointment book. Those of us who handle the patients and the appointments know which patients are under active treatment. The monthly appointments of the active cases are shown on the back of the salmon-colored cards and the patients usually know the day and the week of the appointment. From this, it is easy to find the exact date and hour of the appointment.

It is much more difficult to locate the appointment of an observation or retention patient. In order to facilitate this, a separate visible card system is maintained with a card for each patient, on which all appointments are recorded. In this manner it is possible to trace the appointment of any patient in a matter of seconds. These cards give us an immediate picture of the patient's promptness in keeping appointments, and carry great weight when a question regarding cooperation arises.

This system of keeping records and arranging appointments is the backbone of a successful orthodontic practice. Without this, it would not be possible to give proper care to all patients, even in the smaller practices. In a large practice the quality of service must suffer without an adequate system.

113 West 57th St.

GROWTH IN WIDTH OF THE HEAD OF THE MACACA RHESUS MONKEY AS REVEALED BY VITAL STAINING

A. H. Craven, D.D.S., M.S., Holland, Mich.

ORTHODONTIC interest in the width increments of the developing human head has demanded a knowledge of the location of the contributory growth sites. Naturally, experimental methods have been used to find these areas of growth in the higher primates. Moore[23] has reported the use of alizarin red S to determine the areas of bone growth responsible for increase in height and length of the monkey skull. It was thought that the sites of increase in width also should be investigated by this method.

Following the publication of a provocative article by Keith and Campion,[18] in which growth of the human face was claimed to be due mainly to sutural additions, Brash[4-6] carried out vital staining experiments in the growing pig. From the results of madder feeding, Brash declared that surface apposition and resorption of bone were responsible for most of the growth of the face and cranium. Thus, debate arose on the relative importance of surface and sutural bone growth in various areas of the developing skull.

Brash[6] defended the part played by vital staining experiments in the study of growing bones in the following words:

> It is therefore clear, before we are in a position to make any intelligible or sound comparison between different growth stages of the same bone, such as by way of superimposing one on the other in order to demonstrate real growth changes, that we must be in possession of knowledge of *how* the particular bone grows, of the sites at which bone is added, of the rates at which it is added at these sites, of the situation and extent of bone absorption—in a word, of its individual "mode of growth."

Most of the vital staining studies were performed on the pig, since that animal could be induced to eat madder. The desire to extend the technique of vital staining to other animals led to a search for a component of madder which could be injected. Purpurin and alizarin, the chief derivatives with staining properties for bone, were investigated.[7, 25] Later the synthetic dye, alizarin red S, 1-2 dihydroxy 3-sodium sulfonic anthraquinone, was found to stain growing bone quite well and to be nontoxic at the dosages usually employed.[26] The mechanism of attachment of alizarin red S to bone and growing bone as a calcium alizarinate,[9] as an adsorption to calcium phosphate,[10] or united to the collagenous matrix[27] has not been determined.

Assisted by a grant from the Associate Committee on Dental Research of the National Research Council of Canada.

It has been shown that the staining of bone in vivo requires careful adjustment of the quantity of alizarin red S injected per kilogram of animal weight.[10, 14, 26] Even adult animals showed areas of bone stained red when the dosage was greatly increased. For this reason, comparative measurements of the amount of stain at given growth sites are of doubtful value, unless the dosage per kilogram of animal weight is similar.

Recently, the use of radioactive isotopes of calcium and phosphorus has complemented the vital staining techniques. Jarabak[14] reported that the distribution of Ca^{45} and alizarin red S was similar and that growing bone was more sensitive to radioactive calcium than to alizarin.

Since bone stained with alizarin red S loses the dye when decalcified, the internal structures of the skull have been examined by the use of ground sections or cut specimens. Invariably, the portions in the area of the cut are lost and, unless embedding materials are employed, the small bones of the facial structures become distorted. Although many investigators have used ethyl or methyl methacrylate as embedding media,[22] use of the polyester plastic, Castolite, has been advanced by Kampmeier and Haviland[16]; its inertness to stained tissues has been reported by Kampmeier and Hospodar.[17]

Moore's[23] method of embedding the specimen, surface cutting of the prepared block, and recording of the exposed surfaces photographically is unique in that it allows serial examination of the specimen in one plane without the loss of any areas due to sectioning.

MATERIAL AND METHOD

Two *Macaca rhesus* monkeys, with dentitional ages equivalent to that of a 5-year-old child, were obtained in November, 1952. At the beginning of the experiment, each monkey had a complete deciduous dentition with all permanent first molars erupted, corresponding to the early second period in Baume and Becks'[2] classification.

After acclimatization for six days in the animal house of the physiology department of McGill University, each animal was given the first intraperitoneal injection, 10 c.c. of a 2 per cent solution of alizarin red S in 0.45 per cent sodium chloride. At the time of the injections (December 4) the larger monkey, a male, weighed 2.78 kilograms, while the smaller female weighed 2.28 kilograms. Although quiet after the injections, the animals were active forty-eight hours later. Red stain was eliminated in the feces and urine for about four days. From the fourth to the sixth day after injection the skin of the animals became red, but by the twelfth day had returned to a normal color. The monkeys remained healthy on a diet of fresh fruit, milk, and vegetables for the following month.

A second intraperitoneal injection of 15 c.c. alizarin red S was given to each animal on Jan. 5, 1953. The weights of the monkeys remained the same as at the time of the first injection. On this occasion, the animals were indif-

ferent toward food for a few days. Again the elimination of stain and reddening of the skin occurred. Both monkeys remained healthy for the following month.

It was decided that a useful check on the alizarin red S could be provided by the ingestion of radioactive calcium (Ca^{45}). Through the courtesy of Professor C. P. Leblond, an aqueous solution of $Ca^{45}CO_3$ was made up to pH 1 by the addition of hydrochloric acid. Ten cubic centimeters of the solution, having a radioactivity of 750 μc, was administered through a stomach tube to the smaller animal, which at the time (February 2) weighed 2.28 kilograms.

The male monkey, No. 1, was sacrificed on February 2, twenty-eight days after the last injection. An attempt was made to perfuse with normal saline, under Pentothal sodium, but the animal died before perfusion was completed. On examination, the viscera appeared healthy. Histologic sections of the kidney showed a mild inflammation. The right femur, tibia, and fibula were retained for comparison of skull and long bone growth. The head was removed and macerated by quick immersion in concentrated sodium hydroxide.

The smaller female monkey, No. 2, remained healthy for an additional seven days, showing no change in weight. On February 9, an attempt at perfusion with normal saline was made under Pentothal sodium. This time, difficulty was experienced in the insertion of cannulae, as both arteries and veins were extremely friable. The viscera appeared healthy on autopsy. Soft tissues were dissected from the skull, femur, and tibia without immersion in any aqueous solutions. The alizarin stain was more evident in the cranium of this second monkey.

Both intact skulls were examined, photographed on Ektachrome color film, and then embedded. The mandible of one specimen was tied to the skull with the teeth in occlusion and the whole was embedded in Castolite, a clear plastic with the consistency of glycerin. The addition of varying amounts of "hardener" (catalyst) gave an appropriate setting time,[30] and it was found that layers 3 cm. thick could be readily poured by using the minimum amount of "hardener." The plastic did not cause the reduction of surface stain which had been reported to occur with the methyl methacrylates.[23]

A 15 by 15 by 9 cm. American museum jar was found most practical as a container. The ground-glass lid fit tightly, while the small hole in the lid was used to reduce air pressure. To eliminate bubbles around the specimen, intermittent reduction of pressure was maintained for six to eight hours, but was discontinued before polymerization reached a jellylike stage. The plastic was finally hardened by heating at 40° C. for forty-eight hours. Taper on the inner walls of the museum jar permitted ready removal of the cured block.

Although a shaping machine was used instead of a screw-cutting lathe, surface cutting of the plastic block followed the method outlined by Moore.[23] The shaping machine gave parallel cuts ranging in depth from 0.006 inch to 0.03 inch. Castolite had good machining qualities at cuts about 0.01 inch deep. A $\frac{3}{8}$-inch carbide cutting tool (Carmet, style D-5, grade CA-4, Allegheny Ludlum Steel Corporation) was employed.

Embedded specimen No. 1 was sectioned in the coronal plane at right angles to the eye-ear plane (Frankfort horizontal) and the sagittal plane. Before mounting in the machine, the block of plastic was trimmed to this plane. Each freshly cut surface was polished, using sandpaper in decreasing grits, and buffed without removing the block from the machine. Standardized photographs were also taken with the block still fixed to the machine. Each cut was photographed on Kodak Commercial Ortho film at maximum magnification, using a 9 by 12 cm. Voigtlander single bellows camera. Any cut differing significantly from those which had preceded it was also recorded at the same magnification on 9 by 12 cm. Ektachrome Type B color film.

Evaluation and illustration of the resultant photographs were, again, similar to the method used by Moore.[23] This method employed standardized enlarged prints of the significant cuts recorded on the Commercial Ortho film. Next, the outline of the bony structures was drawn on the prints in waterproof India ink and, by comparison with the color transparency, the areas and amounts of stained bone were indicated by stippling. The inked print was then immersed in a strong solution of potassium ferricyanide which removed the emulsion, leaving a line drawing of great accuracy.

The second animal, containing radioactive material, was embedded and sectioned with a band saw in the same plane as the significant sites revealed by surface cutting. Thus, a series of permanent sections was obtained. They were subsequently smoothed, polished, and pressed into contact with photographic film in a series of casettes. After a period of six months the films were developed, but no radioautographs were visible. It appeared that 315 μc Ca^{45} per kilogram of body weight of the *Macaca rhesus,* administered as $Ca^{45}Cl_2$ (pH 1) per os, was not sufficient to give radioautographs. In an endeavor to elucidate doubtful findings, ground sections from this latter skull were examined microscopically.

FINDINGS

Gross Examination of the Skulls.—

The brain case: Apart from small areas of surface stain on the squama of the frontal bone, the external surfaces of the bones of the cranial vault were unstained (Fig. 1). Different widths of stain were observed along most of the sutures, the widest occurring along the coronal, lambdoid, and sagittal sutures and the narrowest along the squamosal sutures. The sutures lay in variable relationships to the stained areas. Indeed, the lambdoid suture in one skull showed large amounts of stain on the parietal bones and little on the squama of the occipital. In both skulls the intensity of stain along the lambdoidal and coronal sutures increased toward the vertex.

Although the supraorbital margins revealed faint stain in the midline, the stain increased in area and intensity toward the zygomaticofrontal sutures (Fig. 2). Stained temporal crests extended from the zygomatic process of the frontal bone to the junction with the coronal suture in one skull, while the other showed stained superior and inferior temporal lines passing over the parietal bones.

As has been observed in previous studies,[21, 23] the internal surfaces of the bones comprising the cranial vault exhibited stain, but large unstained areas were noticed which seemed to correspond to the convolutions of the brain.

The base of the skull showed heavy staining on the body of the sphenoid and basilar portions of the occipital bones (Fig. 3, *A*). The spheno-occipital synchondrosis was still present. Although the anterior border of the foramen magnum was unstained, the posterior rim showed a little stain extending on to the nuchal plane. It was noticed that the occipital condyles showed little

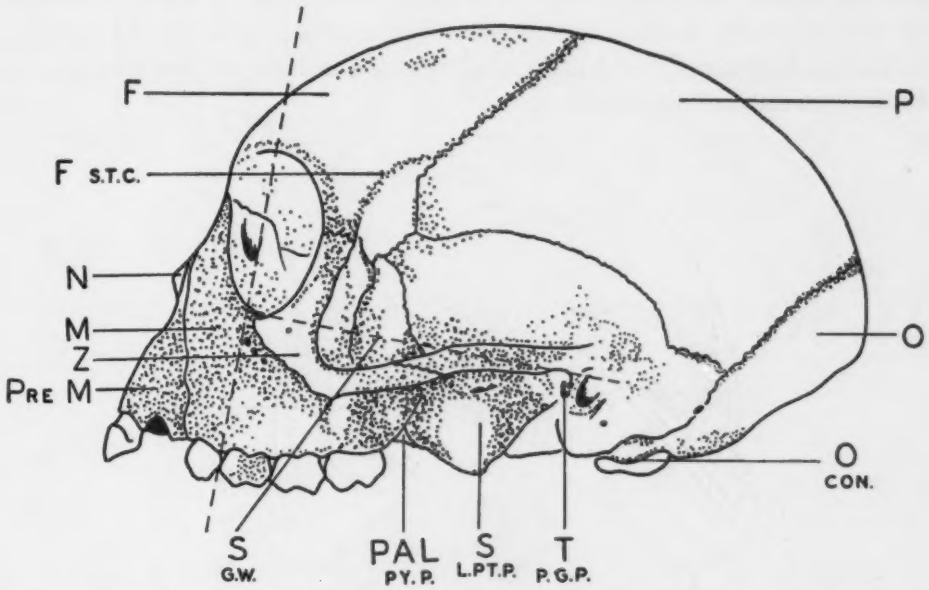


Fig. 1.—Lateral view of skull No. 1. The stippled areas represent the sites and relative intensity of the alizarin stain. The dotted line represents the plane of cut at right angles to the eye-ear plane.

Key to Symbols:

E—Ethmoid bone
F—Frontal bone
F s. t. c.—Temporal crest on the frontal bone
M—Maxilla
Mand—Mandible
N—Nasal bone
Oc—Occipital bone
Ob—Basilar portion of the occipital bone
O con.—Occipital condyle
O jp—Jugular process of the occipital bone
PAL—Palatine bone
PAL py. p.—Pyramidal process of the palatine bone
P—Parietal bone
Pre. M—Premaxilla
Pre. S—Presphenoid
S b.—Body of the sphenoid bone
S g. w.—Great wing of the sphenoid bone
S l. pt. p.—Lateral pterygoid plate of the sphenoid bone
S m. pt. p.—Medial pterygoid plate of the sphenoid bone
T pet.—Petrous portion of the temporal bone
T p. g. p.—Postglenoid process of the temporal bone
T sq.—Squamous portion of the temporal bone
T z.—Zygomatic process of the temporal bone
V—Vomer
Z—Zygomatic bone

stain externally. In contrast to Moore's[23] finding, the entire petrous portions of the temporal bones, in both skulls, were unstained but, in agreement with Moore's specimen, the jugular processes of the occipital and the occipitomastoid sutures showed stain.

The face: Unlike the external surface of the brain case, the face showed surface staining. This was greatest in the premaxillary region and least on the malar surface of the zygomatic bone (Figs. 1 and 2). Neither of the two skulls showed the sharp distinction between the surface stain on the pre-

maxilla and maxillae reported by Moore.[23] On the other hand, the zygomaticomaxillary sutures marked a division between relatively heavily stained maxillary surfaces and nonstained surfaces of the zygomatic bones.

The orbital cavities revealed areas of heavy stain which did not appear to be due to reflections from the thin bones. Most heavily stained were the orbital surfaces of the maxillae. Patches of stain seen on the orbital surfaces of the frontal bone substantiated the observations of Brash,[6] who claimed that the orbital cavity increased in size by resorption of bone in this area. In contrast, the orbital surfaces of the zygomatic bones showed stain increasing in area and intensity toward the margin of the orbit. The lateral surfaces of the zygomatic bones showed little surface stain, although there was some stain near the zygomaticofrontal sutures.

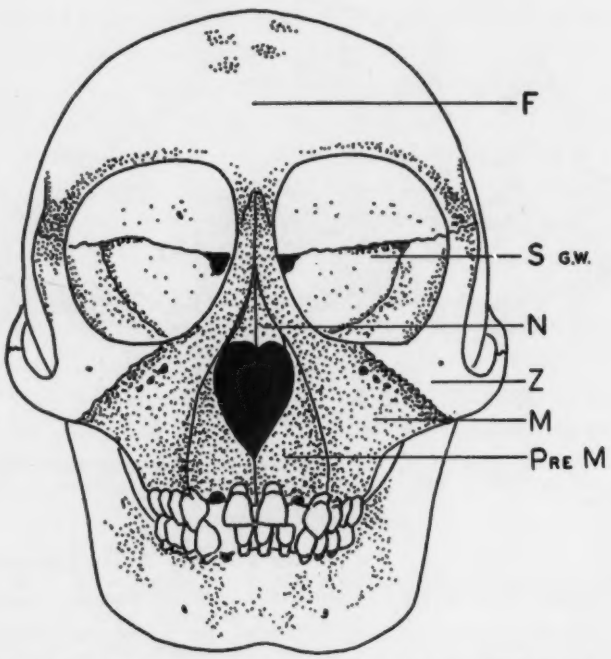
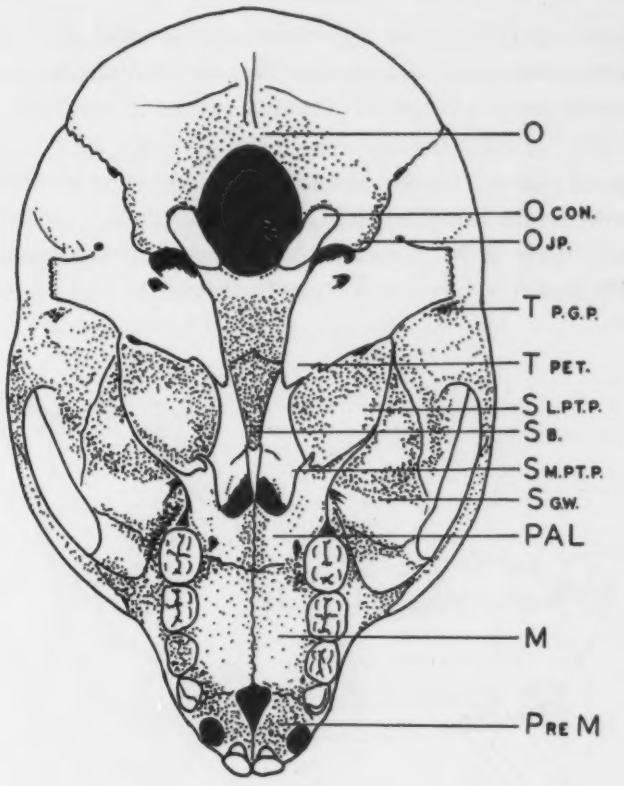


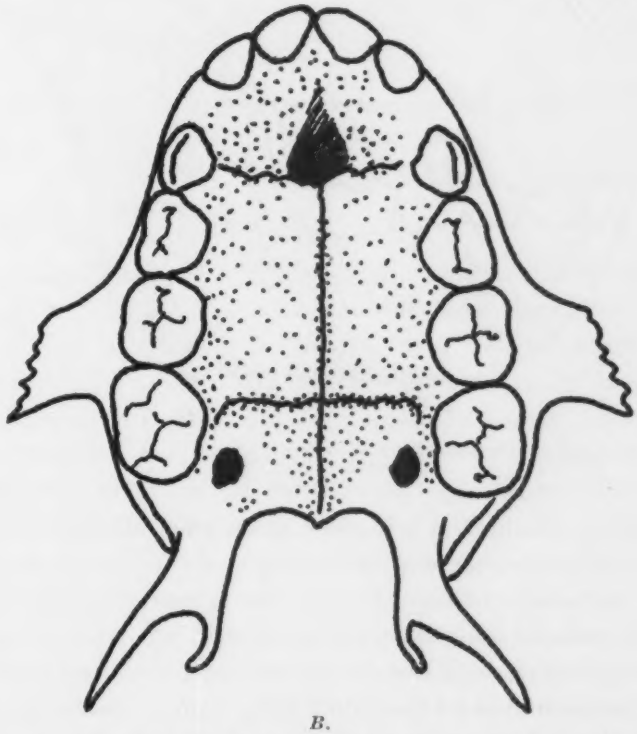
Fig. 2.—Frontal view of skull No. 1. (*For Key to Symbols, see Fig. 1.*)

Contrary to Moore's finding of no stain on the oral surface, the palates of both skulls revealed surface stain, especially in the posterior portion of the midline and lingual to the recently erupted first permanent molars (Fig. 3, *A* and *B*). Although the posterior margins of the hard palate were unstained, both the median and transverse palatine sutures were stained.

The craniofacial hafting zone: According to Moore,[23] "the great wing and pterygoid process of the saphenoid bone, the pyramidal process of the palatine bone and the zygomatic arch are considered the hafting bones between face and cranium." Although the sutures surrounding the great wings of the sphenoid were stained, extensive deposition of stain was observed on the infratemporal surface. This was especially marked along the infratemporal crest which also extended on to the squama of the temporal bone. As had been reported by



A.

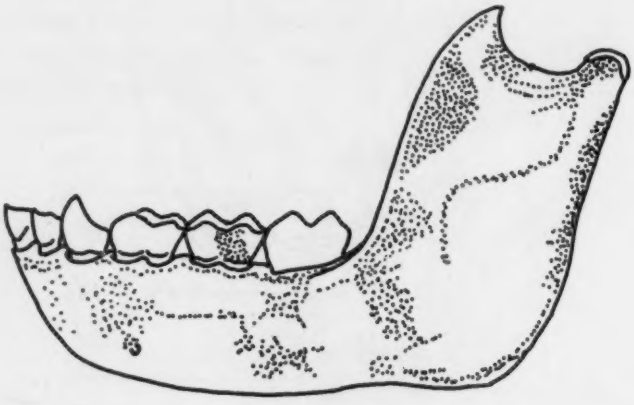


B.

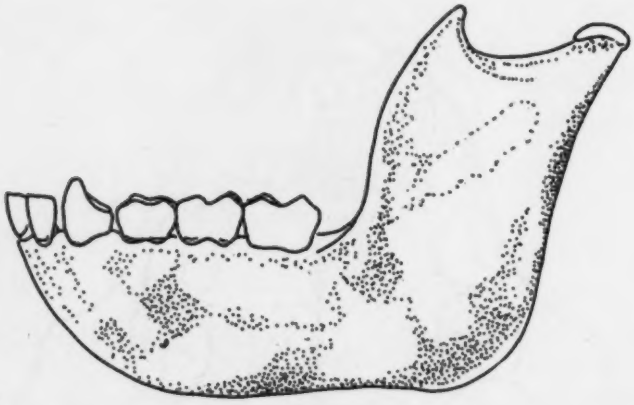
Fig. 3.—*A*, Basilar view of skull No. 1. *B*, Basilar view of the palate of skull No. 2. (*For Key to Symbols, see Fig. 1.*)

Brash,[6] the lateral surface of the zygomatic arch showed stain while the medial surface remained unstained. However, the inferior surface of the arch, the articular eminence on the temporal squama and, surprisingly, the postglenoid process were stained in both animals.

The pterygoid plates differed in their staining. The medial plate exhibited little or no stain, while the lateral plate showed stain, particularly along the posterior border. This finding seems at variance with that reported by Moore,[23] but concurs with Brash's[4] observations in the pig.



A.



B.

Fig. 4.—*A*, Lateral view of the mandible of monkey No. 1. *B*, Lateral view of mandible of monkey No. 2.

The mandible: Right and left sides of each mandible showed similar patterns of stain. However, the distribution of stain on the inferior border of the body of the mandible differed in the two monkeys. The first mandible (animal No. 1) revealed little stain along the inferior border (Fig. 4, *A*), while the second mandible showed deep stain extending along the inferior border from one antegonial notch to the other (Fig. 4, *B*). Stain on the medial surfaces of the body and ascending rami was similar in both mandibles. Like-

wise, the external surfaces of the body and rami of both mandibles showed diffuse areas of stain which seemed to coincide with the sites of muscle attachment.

In support of the historic observations of Hunter,[13] Humphrey,[12] and Brash,[5] the posterior margins of the ascending rami were stained, while the anterior margins were unstained. It was noticed, however, that the distribution of stain on the posterior margins was laterad. The condylar area was not well stained, although a little stain was observed on the anterior surface of the neck of the condyle in the region of the insertion of external pterygoid muscle.

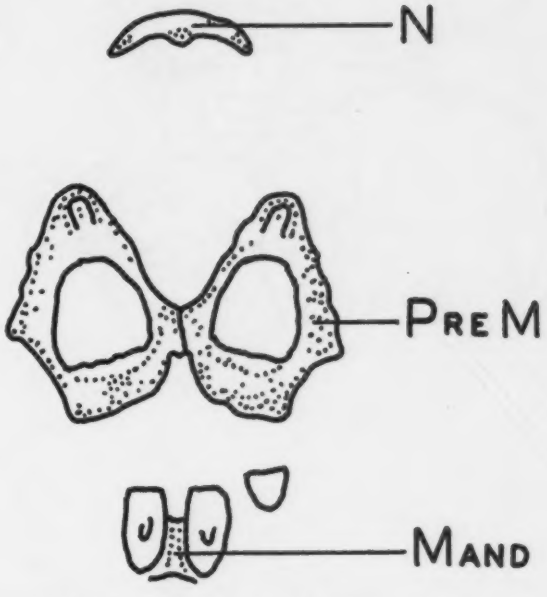


Fig. 5.—(*For Key to Symbols, see Fig. 1.*)

Staining Revealed by Sectioning.—

The brain case: Since the surface was cut in an anteroposterior direction, the first sections approaching the cranial vault were those through the supraorbital ridge of the frontal bone (Figs. 6 and 7). In neither skull was there evidence of the broad band of stain which was observed by Moore[23] to extend from the supraorbital ridge to the inner table of the frontal squama. Although the frontal sinuses had not developed in the monkeys examined, the spongy bone in this area showed small amounts of stain. This was thought to be due to the reorganization of trabeculae.

As had been observed on gross examination, the inner table of the bones of the vault was stained, while the outer surface remained unstained. However, the area and intensity of stain was greatest in the first few cuts of the inner table. This was attributed to the angle of cut, which at first was more oblique. The unstained areas noticed on the internal surface of the cranial vault of the intact skull were seen to be crests on the inner table (Fig. 8).

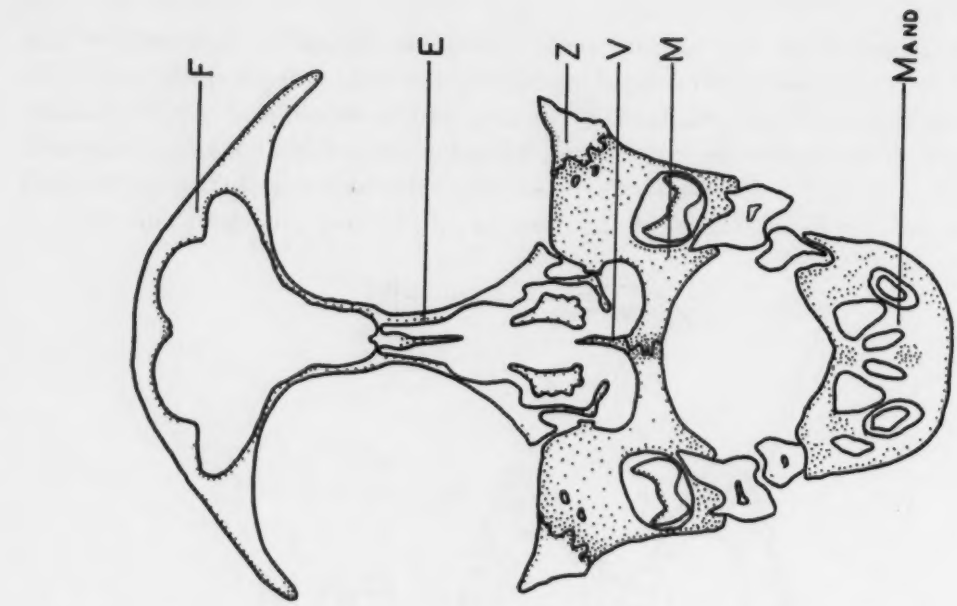


Fig. 7.

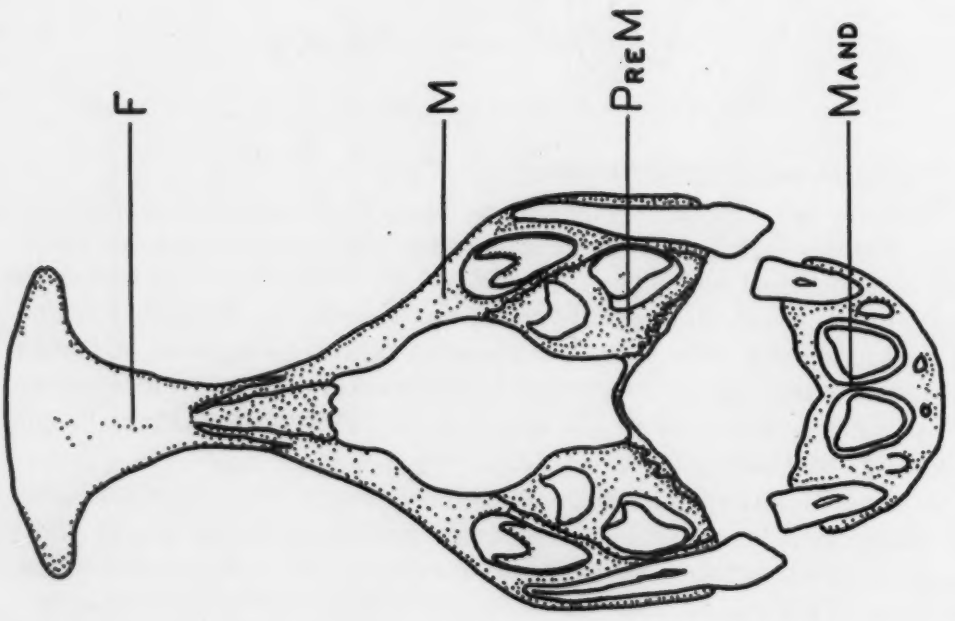


Fig. 6.

(For Key to Symbols, see Fig. 1.)

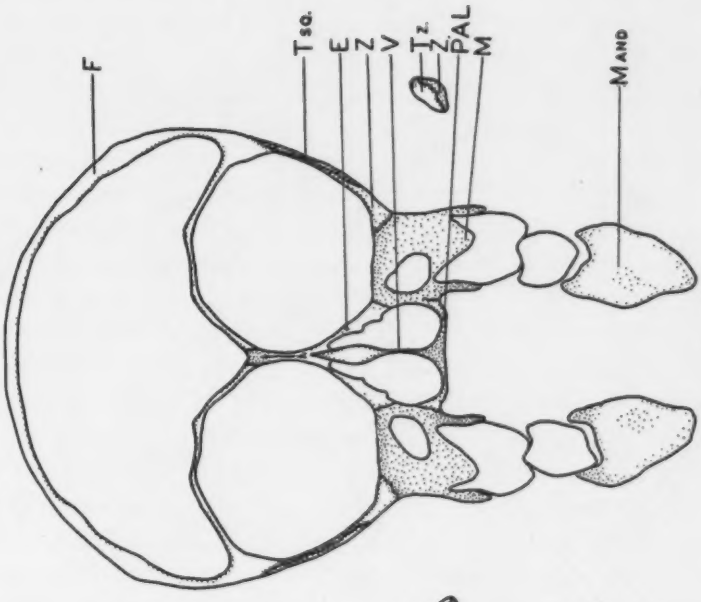


Fig. 9.

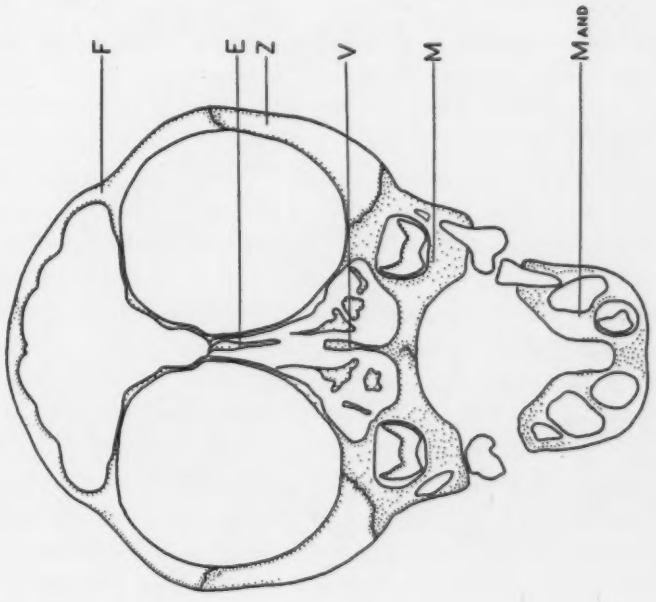


Fig. 8.

(For Key to Symbols, see Fig. 1.)

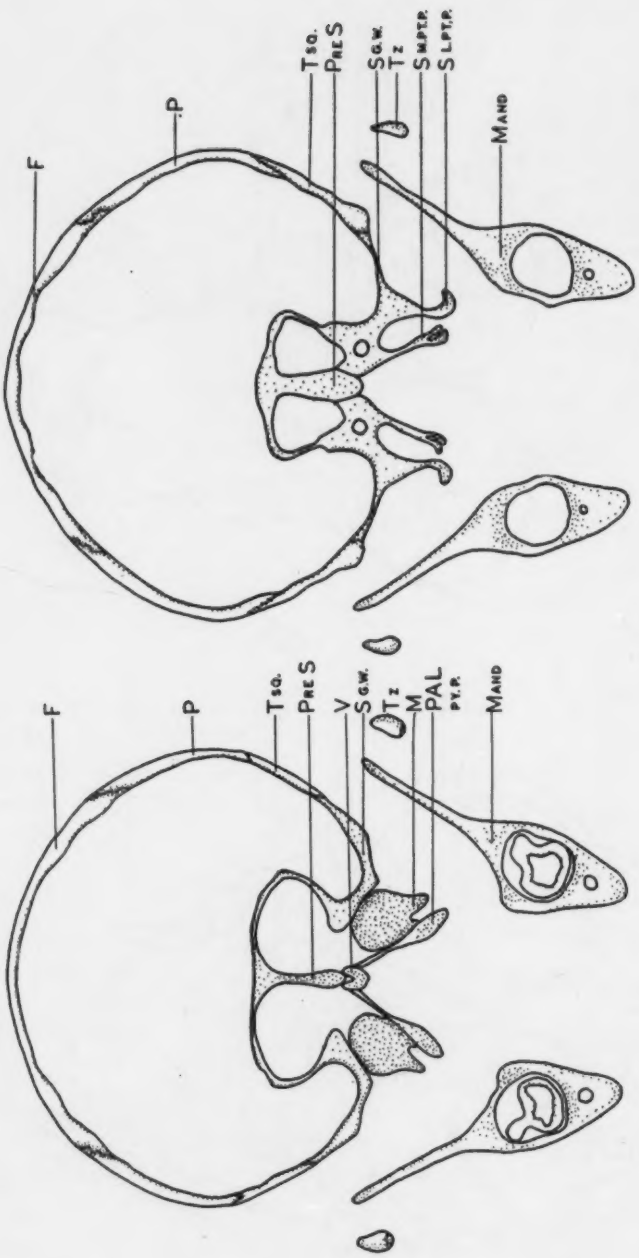


Fig. 11.

Fig. 10.

(For Key to Symbols, see Fig. 1.)

The unusual patches of stain on the external surface of the frontal squama were visible in the sections as surface stain which did not join with that on the inner table (Fig. 8).

The sagittal suture was stained on the adjacent parietal bones, the stain extending from the inner to the outer surface. Examination of ground sections of the sagittal suture of the second skull showed that a certain amount of the stain observed in the intact skull was due to surface deposition on the outer table for a short distance on either side of the sutural margins. The variations in this surface staining led to the appearance of different amounts of stain being deposited on either side of the suture. In contrast to the sagittal suture, the squamosal sutures were only lightly stained.

Sections through the posterior cranial fossa showed sutural staining at three sites—the sagittal suture and the lambdoidal sutures. Stain at these sites, together with internal surface staining, confirms the belief that growth occurs at the sutures in the development of the cranial vault[21, 23] (Fig. 14). As lambda was approached, the intensity of stain within the parietal and occipital bones increased. Both occipital condyles showed stain beneath the articular surfaces, but not of the intensity shown in Moore's study.

With the exception of parts of the petrous portion of the temporal bones, the bones comprising the floor of the cranial cavity exhibited surface staining, that is, the orbital plates of the frontal bone, the great wings of the sphenoid, the squamae of the temporal bones, and the occipital squama. This was similar to the observations of Brash[6] in the pig and the illustrations of Moore[23] in the *Macaca rhesus*.

In addition to alizarin stain on the neural surfaces, the base of the cranium showed stain within the bodies of the presphenoid, sphenoid, and basilar portions of the occipital bones (Figs. 10, 11, 12, and 13). As Moore has pointed out, this stain can be attributed to the reconstruction of trabeculae. However, a distinctly heavier amount of stain occurred on both sides of the sphenoccipital synchondrosis (Fig. 13). The second skull showed only faint staining of the internal structures of the bones in the base of the skull, despite clear staining in other sites.

Fig. 12 shows a section through the tips of the petrous portions of the temporal bones. They were not stained. Apart from small amounts of neural surface staining, the petrous temporals were unstained. This finding differed from that of Moore,[23] who found stain at the tips of the petrous portions.

The jugular processes of the occipital bone showed stain at their abutments with the relatively unstained petrous portions of the temporal bones. Indeed, most of the sutures involving the temporal bones faced laterad in coronal section and all showed evidence of stain, especially the well-stained sphenotemporal sutures. These findings supported those of Keith and Campion[18] and Moore,[23] who claimed lateral movement of the temporal bones in the development of the skull.

The face: The first cuts were entirely in the premaxilla. In skull No. 1, a lightly stained fissure was present between the deciduous central incisors.

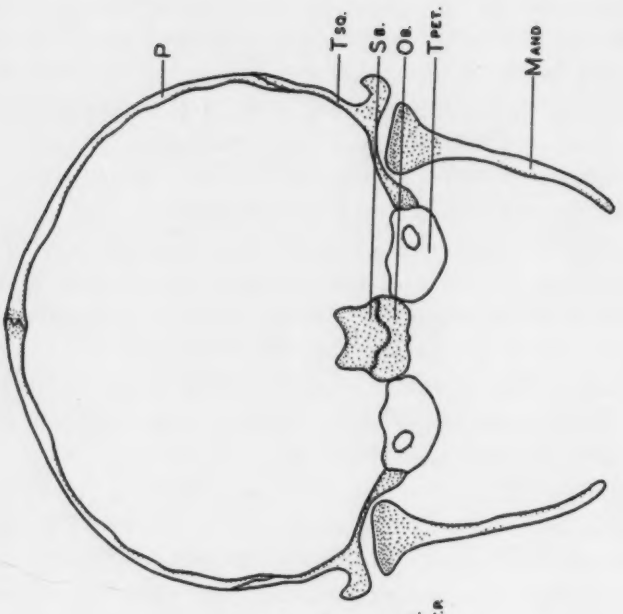


Fig. 13.

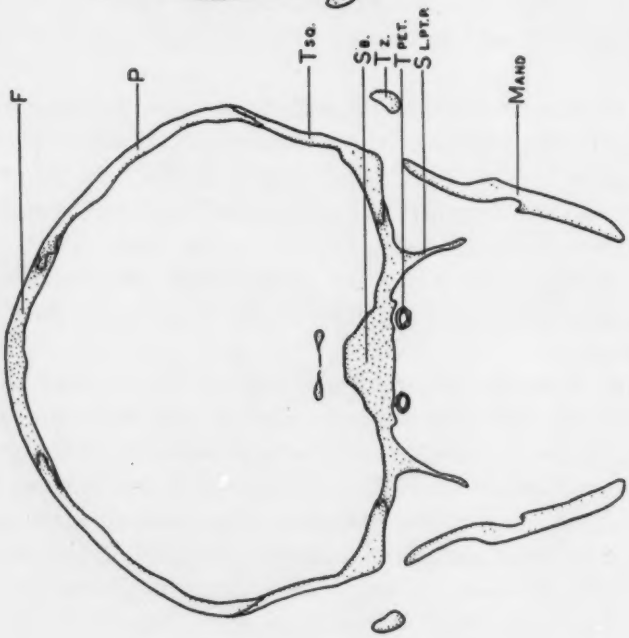


Fig. 12.

(For Key to Symbols, see Fig. 1.)

Although the premaxilla was stained throughout, definite surface staining was still visible in the sections. The sockets of the deciduous teeth showed stain, while the crypts of the permanent incisor teeth showed varying amounts of stain around the periphery (Figs. 5 and 6). All the permanent teeth revealed a thin line of stained dentine close to the pulpal surface. Ground sections of the second skull showed this thin line to be double lines of alizarin stain separated by about 70 microns.

That the premaxilla is a separate bone in the *Macaca rhesus* was well seen in the series of coronal cuts in which the premaxillomaxillary suture appeared as a stained line. Indeed, the premaxilla appeared enveloped by forward-projecting processes of the maxillae. Even the crypts of the permanent lateral incisors were almost encapsulated (Fig. 6). Except where developing tooth germs lay close to the nasal wall, the nasal surfaces of the premaxilla and maxillae showed little stain.

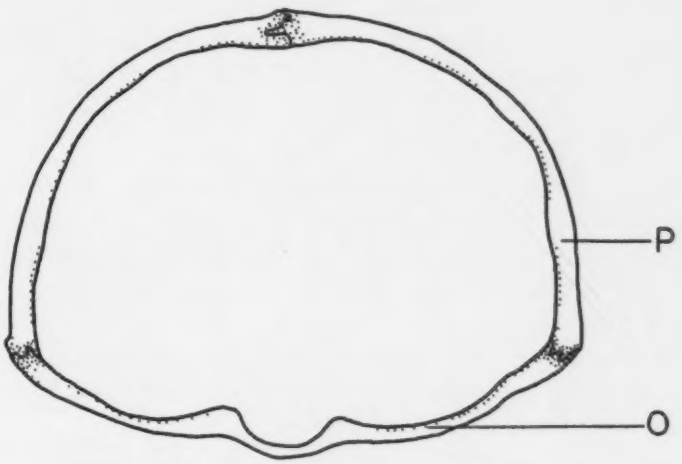


Fig. 14.—(*For Key to Symbols, see Fig. 1.*)

Superior to the dentition, the frontal processes of the maxillae remained faintly stained until the frontomaxillary sutures were reached. Heavy staining in this region tended to confirm the findings of Keith and Campion[18] and Moore[23] that vertical height of the maxilla was gained by addition at the frontomaxillary sutures. Although the sutures had a dentate form, it appeared that both nasal and frontal bones shared in the staining of this area, the former showing a margin of stain at the nasomaxillary sutures (Fig. 6).

Coronal sections through the deciduous canines in the maxillae were of interest in the study of intercanine width. It was noticed that lateral surface stain appeared on the maxillae, independent of the stain in the sockets of the deciduous canines. The crypts of the permanent canines were stained most heavily on their medial and superior walls (Fig. 6).

Later sections of the maxillae showed the deciduous molars with the crypts of the premolars above them. As had been observed in the permanent incisor and canine crypts, the staining on the crypt wall varied; for instance, the first

premolars showed stain along the inferior and lateral walls of the crypts, while the second premolars showed superior staining (Figs. 7 and 8). Both the alveolar process surrounding the recently erupted first permanent molars and the body of the maxillae in these regions were heavily stained. Later sections were also intensely stained (Figs. 9 and 10). This area corresponds to the "alveolar bulb" of Brash[5] and the site of maxillary growth of Moore.[23]

As had been suggested from the superficial examination of the orbit, the stain from the neural surfaces of the orbital plates of the frontal bone extended into the orbit. In most sections the medial walls of the orbits were unstained, while the orbital surfaces of the maxillae were heavily stained. On the other hand, the lateral walls of the orbits were stained in different areas. There was no stain on the orbital surfaces of the zygomatic processes of the frontal bone, although there was surface stain on the lateral sides of these processes. Examination of ground sections of skull No. 2 showed stain on the endosteal surface of the orbital compact bone in this region. This finding confirmed the observations of Keith and Campion[18] that increase in width of the supraorbital ridge is due to appositional growth. However, a distinctly different distribution of stain was noticed on the zygoma below the frontozygomatic suture. Here the orbital surface of the zygoma was stained, while the lateral surface showed only slight varying amounts (Fig. 8).

Coronal sections through the zygomaticomaxillary sutures confirmed the significantly different staining observed externally. The maxillary surface was well stained, while the zygomatic surface did not appear stained. Ground sections revealed distinct alizarin lines on the maxillary side, continuous with those on the orbital surface of the maxilla, and little stain on the zygomatic side of the suture. In all the sections the zygomaticomaxillary suture faced outward and upward, and showed a dentate form near the facial surface and smoother margins toward the orbital surface.

Unfortunately, some of the small bones in the nasal cavity of one specimen were displaced, perhaps due to the shrinkage of the plastic. Even so, both skulls showed stain on the floor and lateral walls of the maxillary sinuses, although the superior surfaces remained unstained. The stain on the floor and walls of the sinuses was assumed to be due to the formation and eruption of the permanent teeth.

The median suture of the palate was stained throughout its length and depth, although the intensity of stain was less in the anterior sections. The stain extended up into the nasal septum. As had been observed externally, sections of the palate revealed a thin layer of stain on the oral surface (Figs. 7 and 8). Although the nasal surface of the palate showed some stain, increasing in amount posteriorly, the intensity and area of the stain did not appear as great as that reported by Moore.[23] The transverse suture of the palate was stained throughout.

The craniofacial hafting zone: Confirming the reports of Brash[6] and Moore,[23] the zygomatic arch showed stain on the lateral surface, but the zygomaticotemporal suture was not well stained (Figs. 9 to 12). Posteriorly, the

glenoid fossae, which may also be considered part of the hafting zone of face to cranium, showed surface staining of the articular eminences, slightly less stain in the depths of the fossae and, as had been noticed in the surface examination, heavily stained postglenoid processes (Fig. 13). This latter finding is in accord with Sicher's[29] illustration of growth of the human postglenoid process.

The posterior sections of the maxillae and palatine bones showed these bones diverging from above outward and downward, with a deposition of stain along the inferior edges (Fig. 10). This observation supported the contention of Brash[5] that the posterior width of the dental arch is obtained by growth in height of divergent processes. Behind this area, sections through the pterygoid plates confirmed the gross examination in that little stain was seen in the medial plates, although intense stain was noticed in the hamular processes.

The mandible: There was little penetration of the embedding material into the body of the mandible, with the result that unerupted teeth frequently became loose during sectioning. Even so, stain was observed in the sockets of the deciduous teeth, on the walls of the crypts of the permanent teeth, and on the crests and lingual surfaces of the alveolar bone (Figs. 5 to 10). As in the region of the maxillary first permanent molars, there was a heavily stained area near the lower first molars. Indeed, the most intense area of stain in the lower dental region was surrounding and posterior to the unerupted second permanent molars (Figs. 10 and 11). Staining in this area was comparable in intensity to staining at the site of the "alveolar bulb" in the maxilla.

Sections of the body of the mandible showed a midline stain which increased in intensity as the lingual surface was approached. Since the stain did not extend through the symphysis, it was interpreted as being the formation of the "simian shelf." Later sections of the body showed an arrangement similar to that observed in the unsectioned mandible.

Surface deposition of stain was noticed on the medial side of the ascending rami, but only small amounts were seen laterally. In section, the tips of the coronoid processes were well stained (Fig. 11). Although the condylar heads of the mandible were free from stain superficially, they were intensely stained below their articular surfaces (Fig. 13). It was noticed that the stained trabeculae lay in a vertical direction, ending on the stained endosteal surface of the cortical bone of the neck of the condyle. A similar type of staining has been shown to occur in the growing ends of long bones, by the use of madder[24] and radioisotopes.[19] Jarabak and his associates[15] have also found this type of growth in the mandibular condyles of the rat.

DISCUSSION

Massler and Schour[21] and Moore[23] have suggested that the primary sites for enlargement of the cranial vault are the sutures and that the thickness of the bones is obtained by deposition of bone on the internal surfaces. The present study tends to confirm these observations, but differs in that unstained crests of bone were noticed on the internal surface of the vault. In order to

examine the possibility of these crests being extremely active sites of bone deposition, ground sections were made from the second skull. These sections showed no stain below the unstained areas. It is thought that these crests correspond to the sulci of the brain and provide contact with the brain, while the remainder of the inner table of the skull increases in thickness by apposition of bone. Perhaps, by this means, there is a transient smoothing of the inner surface of the vault to which the crests of the digitate depressions are later added.

External surface deposition of bone, on both sides of the sagittal suture, was considered to be a process of remodeling of the parietal bones so that their curvature became less as the cranium increased in size. A possible explanation for the deposition of bone on the external surface of the frontal squama was found in the behavior of the animals. It was observed that the monkeys would leap from a window to a pipe which passed close to the ceiling of the animal cage. Thus, the patches of stain on the frontal bones may have been due to blows on the forehead.

Keith and Campion[18] believed that increases in width of the supraorbital region occurred by apposition and resorption of bone. Recently, Gans and Sarnat[11] found metallic implants, initially on the lateral surface of the zygomatic process of the frontal bone, moving toward the medial surface with growth. This, together with Brash's[6] work on the pig and the present study, would seem to indicate that the upper portion of the orbit increases in size by a process of surface resorption with external deposition of bone. However, this mechanism for increasing the size of the orbit does not seem to occur below the zygomaticofrontal suture. Since this suture faces downward and laterad, it could be assumed that the zygoma was carried laterally by growth at the suture as well as by the lateral movement of the zygomatic process of the frontal bone. These lateral increments appear to be greater than necessary, with the result that compensatory apposition of bone takes place on the orbital surface of the zygoma to maintain orbital contour.

Not only the superior edge of the zygoma, but also the inferior edge at the zygomaticomaxillary suture, was moved laterad during growth. Here the chief contributor is the maxillary surface of the suture. The zygomaticomaxillary suture has been claimed as contributing to the downward and forward growth of the face, but it would seem that this suture, as a surface, contributes mainly to width of the face. Indeed, if one were to say that the floor of the orbit and its continuation, the maxillary portion of the zygomaticomaxillary suture, is a surface of growing bone, Brash's concept of surface growth of the facial bones could be reconsidered. In this manner, the maxillae would slide outward and downward beneath the zygomata. It is most likely that growth on the superior surface of the maxilla is compensatory, to maintain orbital size. Thus, it offsets downward movement of the maxilla due to growth at the frontomaxillary suture[8] or downward and forward growth of the nasal septum.[28] Indeed, the potential for growth of the nasal septum in the human being is quite high, as observed in the uninhibited growth forward of the premaxillary element in bilateral cleft lip and palate patients.

Moore[23] observed stain on the nasal surface of the palate; he claimed that this was evidence for compensatory growth, similar to that on the orbital surface of the maxilla, and designed to prevent overenlargement of the nasal cavity. However, Gans and Sarnat,[11] noting changes in the palatal plane in the serial radiograms of their monkeys, wrote: "The floor of the nose was found to have descended to a lower level than could be accounted for by growth of the frontozygomatic and frontomaxillary sutures." They supposed the difference to be due to surface apposition and resorption. Stain observed on the oral surface of the palate in this study, as well as similar findings in the pig by Brash,[5] tends to confirm the supposition that the palate descends by surface apposition and resorption of bone.

That the zygomatic arch increases its distance from the temporal fossa by surface apposition of bone laterad and resorption mediad has been well established.[6, 18, 23] The fact that, in this study, only moderate amounts of stain were observed in the zygomaticotemporal sutures was of particular interest, since it had been claimed that growth occurring at this site increased the anteroposterior dimensions of the head.[11, 23, 29] It appears that lateral growth of the convex arch can be a significant contributor to the anteroposterior dimension. By changing the arc to one with a greater radius, an increase in the length of the cord is obtained.

It was thought that the insertions of the internal and external pterygoid muscles may have been responsible for the stain observed on the lateral pterygoid plates. On the other hand, the absence of stain on the medial pterygoid plates implied that width increments of the pharynx were attained prior to an age comparable to that of a 6-year-old child. The stained hamular processes could produce an increase in height or, most likely, new bone for the attachments of tensor veli palatini muscles.

Immediately in front of the pterygoid processes, the palatine bones and tuberosities of the maxillae showed greater laterad and downward growth. Since this change must be reflected by an increase in width of the palate, it was not surprising to record stain in the median palatine suture. Although Keith and Campion[18] suggested that the median suture was responsible for increased width of the human palate, Brash[5] has claimed both surface and sutural growth to be responsible. It would seem that the median sutural growth is an adjustment mechanism, compensating for lateral movements of the palatine and maxillary bones.

Moore[23] has claimed a prolific and independent growth of the premaxillary element. In view of the encapsulation of the premaxilla by the maxillae and the observations by Gans and Sarnat[11] that little growth occurred in the premaxillo-maxillary sutures, it would seem that the stain observed in the premaxilla is due to the reorganization of bone to accommodate the erupting permanent teeth.

In 1922, Keith and Campion[18] illustrated lateral movement of the glenoid fossae and claimed growth at the sphenotemporal sutures to be responsible. Later, Moore[23] suggested that the petrous portion of the temporal bone was carried laterad during growth and compensatory growth occurred at the tip

of the petrous portion. Although in the present study no stain was seen at the tips of the petrous portions, stain along the sutures abutting against the temporal bones indicated lateral growth. Indeed, the series of coronal sections of the cranial base, with the mandible in situ, gave the impression that lateral movement of the glenoid fossae and divergent growth of the mandibular condyles were synchronous. Certainly, the phylogeny of the temporomandibular joint would imply similar development of the two bones. It is interesting to notice that Pierre Marie,[20] in his thesis on acromegaly, said of one patient: "The temporal bones also project from the surface of the cranium." This seems to offer a very interesting field for future investigation, with particular reference to arrested growth of the mandible.

There have been few studies reported on vital staining techniques applied to the monkey's mandible. Different amounts of stain along the inferior and posterior borders of the mandible, as observed in the two mandibles studied, could be responsible for variation in the form of the mandible. Thus, in addition to directional growth at the condyle, there exists the possibility of increasing mandibular height by deposition of bone along the inferior border. This type of growth may be responsible for the changing morphology of the inferior border of the mandible in the growing human being, the extreme adult form being the "rocker" mandible seen in primitive human races. Lateral staining of the posterior edge of the ascending ramus confirms the report of Baume.[1] Growth at this edge appears to be necessary to maintain mandibular form, since the divergent condyles increase in width and height.

In the mandible, as in the rest of the cranium, the sites of muscle attachments were stained. Perhaps this stain is due to the reattachment of muscle to growing bones, the osteogenic capacity being in the muscular tissue, as has been advanced by Baume and Becks.[3]

CONCLUSIONS

1. Castolite, a polyester plastic, when used as an embedding material, does not reduce the surface staining of bone which has been stained in vivo with alizarin red S.

2. The cranial base increases in width at the temporal bones which are displaced laterad by sutural growth. It is likely that concordant divergent growth of the ascending rami of the mandible enables the glenoid fossae and mandibular condyles to remain together during lateral growth of the cranial base.

3. The zygomatic bones are moved laterad by growth of the adjacent bones, and, in order to maintain orbital contour, compensatory medial surface growth occurs on the orbital surface of the zygomatic bone.

4. Growth in width between the tuberosities of the maxillae and palatine bones in the monkey is achieved by downward growth of divergent processes. However, this mechanism is not operative in the pharynx, as represented by the medial pterygoid plates, at the age of 21 months.

5. Growth in width of the palate is associated with growth of the median palatal suture and the divergent alveolar processes. This is a situation similar to that reported in the pig by Brash.[5]

6. Increase in height of the nasal cavity is obtained by apposition of bone on the oral surface of the palate and resorption on the nasal surface.

7. The maxillae and premaxilla increase in width by surface addition of bone.

8. Growth in height of the body of the mandible in the monkey is dependent, to a certain extent, on surface addition of bone along the inferior margin.

9. Growth in width of the mandible is due to divergent growth of the mandibular condyles and lateral deposition of bone on the posterior edges of the ascending rami.

SUMMARY

Two *Macaca rhesus* monkeys, corresponding in dental age to a 5-year-old child, were injected with a 2 per cent solution of alizarin red S at monthly intervals for two months. The skulls were macerated and embedded, intact, in a polyester plastic, Castolite. One of the skulls was sectioned in a coronal plane at right angles to the eye-ear plane (Frankfort plane). Surface cutting and standardized photography were employed in a manner similar to that described by Moore.[23] The other skull was sectioned by a band saw at the most interesting sites revealed by surface cutting.

Growth of the cranial vault was associated with sutural addition and the deposition of bone on the inner surface of the cranium. Increase in width of the cranial base contributed to lateral movement of the temporal bones. There appeared to be a relationship between separation of the glenoid fossae, due to growth of the cranial base, and the increase in width between the growing mandibular condyles. Increase in width of the facial structures was due to both surface and sutural growth. The latter was particularly evident at the frontozygomatic and zygomaticomaxillary sutures, contributing to lateral movement of the zygomata, while surface addition of bone was noticed on the oral surface of the palate and lateral surfaces of the premaxilla and maxillae.

Increments in width of the mandible were mainly surface additions to the lateral edges of the posterior borders of the ascending rami, together with upward and outward growth of the condyles, in a manner similar to the growing ends of long bones.

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ORTHODONTIC PERSPECTIVE

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THE president of Fordham University, Rev. Robert I. Gannon, S.J., has made the significant statement that "perspective is the principal element of knowledge, and few people are profound enough to have perspective with regard to the passing show."

It can be safely stated that all the trials and tribulations from which orthodontics has suffered in the past and is suffering at present can be laid directly on the doorstep of this pivotal issue.

This is quite understandable because few men, if any, fully realize the fantastic complexity of orthodontics from the purely scientific standpoint; therefore, how easy it is for many narrow-minded and conflicting viewpoints to have been developed due to that all too common human error of "losing sight of the woods because of the trees." Man's main difficulty in life is to obtain an adequate point of vantage from which to view his problems in their entirety.

The main difference between men and their accomplishments as enduring contributions to progress is a matter of perspective—the ability to take the big view, to see things in their true relation to a broad and comprehensive whole, and to resolve a problem to a single mental picture. This is a very rare gift and something quite apart from mere education. It contains the element of greatness. It is the first essential in the make-up of every true artist and no really good orthodontist can possibly be without it.

It would be unpardonably conceited for anyone to include himself in the select group of the few who are "profound enough to have perspective with regard to the passing show." There is, however, no reason why anyone in orthodontics should so flatter himself, because some of the misconceptions which are plaguing the specialty at present are so obvious that it takes only a very small degree of intelligence to disclose the false basis on which some of them stand and the enormous amounts of time and effort which have been wasted, and are being wasted, on studies and investigations which lead to narrow-minded, illogical, and misleading conclusions of no practical value.

In order to view orthodontics with correct perspective, it is necessary first to consider it in its broadest sense, and in doing this it is categorically imperative to deal with some astronomical figures with regard to periods of elapsed time as well as the collective numbers of specimens of the human race which must be considered.

Read before the graduating class of the Dental Department of Ohio State University, Columbus, Ohio, March 12, 1956.

The present population of the world is estimated to be in excess of two and one-half billion human beings. These, however, are a mere handful or sample of the untold numbers of generations and the eons of time which have gone into the production of the present generation, and in relation to which must be considered the infinitesimal number of those which are of prime interest to orthodontists of the present day and age.

Everything that lives and breathes is naturally the direct result of its own peculiar heredity and environment, and in the human being it is natural that when these two factors have been homogeneous over long periods of time, a more or less standardized type of individual is produced. This is evidenced in the case of the Eskimo, the Kafirs of Africa, and many other ethnic groups where these conditions have prevailed. It would be impossible to estimate just how long it takes to establish a satisfactory type which would measure up to the standard that would please the average orthodontist. Holy Writ tells us that a thousand years are as but a day in the eyes of the Creator; as it is only within the last 150 years that it has occurred to some enterprising persons that some improvement can be made by altering the natural genetic patterns of some of their fellow men, it is only natural that some differences of opinion should have arisen between those who have embarked on such a stupendous project.

In the last few hundred years, the means of communication have developed in such a prodigious manner that great masses of the human population have been transplanted to totally different environments from those to which their forebears have been accustomed for generations. There are few pure races left, but into these United States of North America probably the greatest conglomeration of different nationalities in the history of the world have been thrown together with little, if any, knowledge and absolutely no regard for the laws of heredity, which includes the most unpredictable of all elements, the factor of hybridization. This has produced an infinite variety of combinations.

Unless something definitely pathologic is present, the resultant combinations of component elements are both natural and normal for the specific individual. These, however, are only very rarely ideal, and in the majority of cases they are very far from being even remotely satisfactory.

Nature rarely produces perfection in anything, least of all in anything as fantastically complex as the human organism. That is why we have so few Hollywood stars or mental geniuses in the world.

Orthodontics is, consequently, mainly the science and art of dealing with unsatisfactory genetic patterns.

One of the commonest errors is to confuse our concept of the ideal with normality. In the human being normality, although concretely indefinable as to any specific individual, can be estimated only on the mean or average of a group. On this basis, as compared with our concept of the ideal, it is therefore quite normal and natural to be fairly ugly, inefficient, and stupid.

This naturally is not what we would like for ourselves and for those unfortunates whom we so ignorantly and heedlessly have been instrumental in

bringing into this world. As the teeth and their surrounding tissues are amenable to improvement if approached with some degree of intelligence, the specialty of orthodontics has come into being, suffering though it is at present from the growing pains of youth and the inherent ignorance, stupidity, and intolerance of those of us who have applied ourselves to the fantastic complexity of its problems.

If we attempt briefly to define orthodontics in its most comprehensive way, we might say that it consists of bold and audacious attempts to alter the entire natural genetic and functional patterns of certain specific, unique, infinitely variable, scientifically incalculable, and unpredictable human individuals. These changes include their teeth, bones, temporomandibular joints, and esthetic facial proportions. To be more specific, the factors involved include the whole gamut of heredity and environment, the infinite variations and combinations of anatomic proportions, physiologic functions, psychologic motivations and habits, diseases, endocrine imbalances, traumatic injuries, mutilations, and gross abnormalities. The resultant composite combinations which all these factors with their infinite variations are capable of producing must be appraised and balanced by the would-be orthodontist into single, all-inclusive, specific, and individual mental pictures and, when judged unsatisfactory, altered by natural and artificial means into other specific, unique, all-inclusive, three-dimensional arrangements which will remain in satisfactory and stable conditions of structural, functional, and esthetic equilibrium. Brash has well defined it as the "experimental control of the experiments of nature."

As can be clearly seen, the factors involved are numerous, impossible of exact scientific appraisal or calculation (either singly or in their relations to an all-inclusive whole), and never quite predictable in their reactions to forces which disturb their natural anatomic and physiologic equilibriums.

To omit from consideration or to miscalculate a single factor of this complex or to overemphasize the importance of one or more of them and disregard others as a basis of diagnosis and treatment is untenable scientifically, philosophically, and artistically. The mistaken concepts arising from this fundamental error constitute the reason for the confusion and the intolerant differences of opinion which exist between orthodontists at the present time.

On a purely scientific basis, the practice of orthodontics is, and always will be, completely impossible for the simple reason that infinite variation, in orthodontics or anything else, cannot conform to any obviously futile attempts at exactness of formulation which are based on hopelessly inadequate statistical, quantitative, dimensional, or orientative plans which leave out of consideration functional and volitional elements which are quite impossible of exact scientific calculation.

Any attempt to classify an individual on a scientific basis of statistics and orientation of specific anatomic parts is a hopeless quest from the outset, even if thousands of cases are used as a basis of study. This is particularly futile when totally inadequate means are used as the basis for making the comparisons and all important decisions which must be made in active treatment. In view of the astronomical figures which must be taken into account,

the statistical approach is too absurd even to be considered. Although of some value to physical anthropologists, the cephalometric method at present employed in orthodontics is so incomplete and inaccurate that dependence on its use may not only distort all sense of proportion, but may lead to some extremely dangerous diagnostic decisions.

The flat, unilateral tracings of hemispheric cephalostatic radiographs which have been flooding recent literature and orthodontic gatherings represent, at best, only one-third of the actual anatomic picture. Persons are seldom, if ever, symmetrical.

Notwithstanding all these factors, the Research Section of the American Association of Orthodontics selected as the prize essay for 1954 a graduating thesis comprising a meticulous and laborious statistical, unilateral, cephalometric analysis of less than fifty individuals who did not present any very great anatomic variations. (Published in condensed form in the June, 1955, issue of the AMERICAN JOURNAL OF ORTHODONTICS.)

As this choice apparently has not provoked any comment, the prize for 1955 was awarded for a thesis along similar lines, but including a total of 100 cases. (Published in the October, 1955, issue of the AMERICAN JOURNAL OF ORTHODONTICS.)

This second award represents an improvement of more than 100 per cent in the number of cases analyzed over the prize essay of 1954. However, as the total number of these cases can be considered only in their relation to the totals of population which run into millions, if not billions, the conclusions (if any) which can be derived from their study are rather difficult to understand.

This fact is pointed out at this time because, if we have any hopes of lessening the confusion which at present is the most unfortunate feature of orthodontics, the whole subject of necessity must be viewed from a broader aspect than it is at present by some members of the profession and particularly by those who are engaged in trying to inculcate in students some idea of what the nature of orthodontics really is and how its problems should be approached in a logical and practical manner.

If the differences of opinion which at present exist between orthodontists are ever to find a logical and satisfactory solution, it can be only on the basis of a common agreement on some very broad generalities, and the clinical use of some principles of treatment of universal application to infinite variation. On this broad basis alone will the numerous and totally different concepts and methods of treatment, including appliances, find their logical and final places of definite usefulness.

SCIENCE—PHILOSOPHY—ART

In dealing with the problems of life, man always has at his disposal and uses, whether he realizes it or not, three basic methods of approach. These are the *scientific,* the *philosophic,* and the *artistic.* The success which he may expect to attain in any effort depends upon the nature of the problem and the relation of these three methods of approach to it.

It is well to start with a consideration of the nature of these three methods of approach. The *scientific* comprises all the classified factual knowledge which is available. Unfortunately, this is only an infinitesimally small fraction of the unknown, unknowable, and utterly incalculable. Mere facts that are not illumined by philosophy or art are worth little.

Philosophy has many definitions, but for practical purposes it must include, in a broad sense, a reasonable attitude and deductive logic and, above everything else, plain common sense. The great Swedenborg said, 200 years ago: "Knowledge without reason, a vast mass of things in the memory without judgment to separate and clearly distinguish them, and without the talent of deducing the unknown object of inquiry from certain known data by means of a rational analysis, in a word, the possession of the means without the faculty of arriving at the end, does not make a philosopher."

Factual knowledge and the talent for knowing how to use it theoretically should be of great help to an orthodontist, but as the purposes of orthodontics are entirely creative, orthodontists must of necessity use the third and far more important approach, which is the *artistic*.

The definitions of *art* are sufficient to fill a volume, but for purely practical and absolutely necessary purposes, they include the qualities of creative imagination, inventive ingenuity, natural skills, acquired skills, and in its highest form of development the very rare quality of intuitive perception. It will be noted that, starting with *science* as a basis, the qualities necessary to produce a highly efficient orthodontist increase in sublety as they ascend the scale through *philosophy* up to the highest peak of *art*, which is intuitive perception and beyond which runs the rarefied atmosphere of genius. So far, in its infancy, orthodontics has not had an outstanding genius who could point the way from the combined standpoint of science, philosophy, and art. There have been, however, individuals in other fields of effort, particularly medicine and education, to whom some of the attributes of genius could be attributed, and there is no reason why orthodontics should not benefit by applying some of their thoughts to the present confusion and misunderstandings which are holding back its progress. For example, William James had this to say: "A concept which cannot be translated into terms of experience or practice is meaningless." Also, in writing his *Principles of Psychology*, which is a far more complex subject than orthodontics, he said: "I have expressly avoided the outward appearance of doctrine and system, the definitions, classifications, subdivisions, and multiplication of technical terms, because I knew that these things tend to substitute an artificial schematism for the living reality with which I wished to bring my reader into direct concrete acquaintance, whether he should have technical names to call its parts by or not."

It would be difficult to find one short paragraph which more perfectly expresses the overenthusiasm for and overimportance of cephalometrics which is at present distorting the broad panoramic concept of orthodontics.

Fig. 1 shows diagrammatically the relationship which science, Philosophy, and art bear to each other. It will be noted that the largest space has been allotted to science because it is much easier to be a scientist (of sorts) than it is to be a philosopher or an artist. In fact, in the ascent to the peak of this triangle, the persons who can qualify for all these characteristics, unfortunately, become rarer and rarer and many there are who cannot qualify at all.

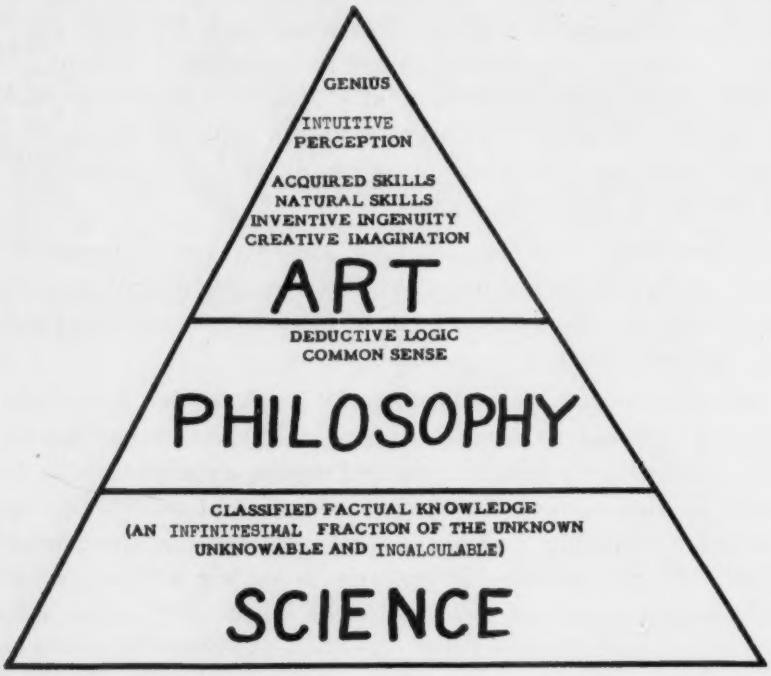

Fig. 1.—The three approaches to all the problems of life. It will be noted that, starting with *science* as a basis, the qualities that are necessary to produce a highly efficient orthodontist must necessarily include correct proportions of all three. They increase in subtlety as they ascend the scale through philosophy up to the highest peak of *art*, which is intuitive perception beyond which there is to be found the rarefied atmosphere of *genius*. It is much easier to become a scientist than it is to be a philosopher or an artist. The persons who can qualify for all these gifts become rarer and rarer and there are, unfortunately, many who cannot qualify at all.

In starting the pilgrimage of acquiring an education, every human being starts from infancy in complete and blissful ignorance. There are, however, great differences in human individuals as to their mental qualifications. Roughly, they can be divided into four main types: the intelligent, the gifted, the dull, and the stupid. In order to qualify for any profession, they all have to go through a long period of preparatory education. Formal education has a different effect upon different persons, depending upon their aforementioned qualities of intelligence, dullness, or stupidity. There are, naturally, far more dull and stupid persons than there are persons who are gifted, and the dull or naturally lazy either do not have the capacity to think for themselves or, in any case, are only too glad to find someone to do their thinking for them or hand them a formula which they think will do the work they wish to accomplish without involving any disturbing personal mental effort.

The truly great scientist, philosopher, and teacher, the late Professor Whitehead of Harvard, has said that education itself runs through three stages:

First stage: Romance; the stage of initial appreciation.
Second stage: Precision; breadth of relationship subordinate to exactness of formulation.
Third stage: Generalization; return to romanticism with the added advantage of classified ideas and relevant techniques.

It is imperative to consider these three stages of education in their relation to orthodontics. The first stage—romance—is that stage at which everybody looks at the subject in which he is interested in its broadest sense. If a person is intelligent, he may initially have a very sound concept of what he has to deal with, as his mental approach is fresh and not disturbed by any inhibitory influences. Many of the most successful men in the world have been men of practically no education, but endowed with great faculties of common sense, creative imagination, inventive ingenuity, and personal skills. Henry Ford happened to be one of these. When he wanted an answer to some purely scientific problem, he did not squander his efforts in acquiring a great deal of book knowledge; he could always find someone who was scientifically educated who could give him the facts from which he could conjure his own technical answer.

Naturally, anyone who is confronted with the tremendous complexities of orthodontics at first blush should feel very modest and timorous in presuming to apply his own uneducated and untried ideas in regard to practical problems. Therefore, nothing is more alluring than to find some method of procedure which will take the responsibility for decisions off his shoulders. It is very easy to see, therefore, how anyone can lose his sense of perspective under the delusion that he can find his answers in methods of exact precision. This is the calamitous heritage which Angle and his followers have given to orthodontics. Those who by natural instinct and intelligence have been able to bypass this "death trap" of orthodontics are, whether they know it or not, practicing orthodontics in the third stage of education which, as Whitehead has stated, comes under the heading of "Generalization," a return to romanticism with all the creative imagination which that implies, plus the benefit of *classified ideas* and *relevant techniques*. The greatest stumbling block in the progress of orthodontics at the present time has been the futile effort to reduce it to the second stage of education. The reason for this is perfectly obvious; neither infinite variation nor the subtler qualities of art permit exactness of formulation. Figs. 2, 3, and 4 have been devised in order to make this graphically clear.

Every truly successful orthodontist knows perfectly well that the infinite variations with which he is faced in everyday practice, the unusual combinations of factors, and all the other problems he has to deal with in seeing large

numbers of cases call for an elasticity of mind and an artistic feeling which can never be brought down to any semblance of exactness of formulation. Angle's classification was considered, and is yet considered by many, as the basis of orthodontic diagnosis. Professor Simon also devised a classification which he was frank enough to admit was based on a fictional basis and in which, to the Anglo-Saxon mind, the terms *distraction*, *abstraction*, and *protraction* seem singularly appropriate.

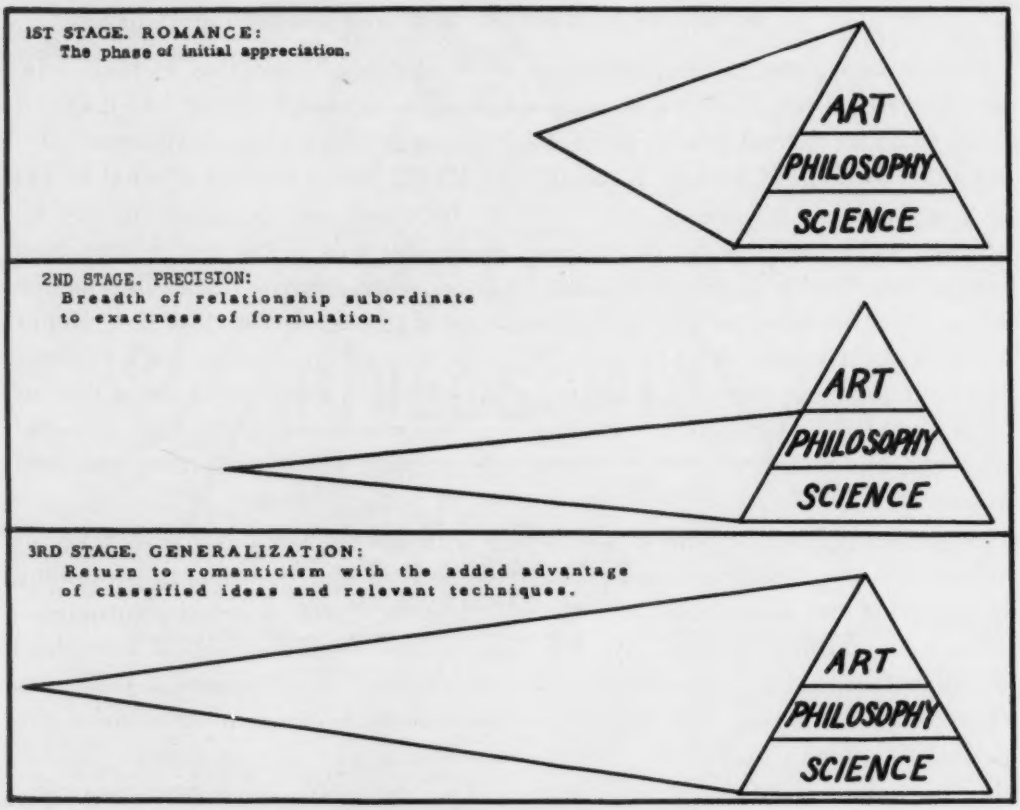

Fig. 2.—Whitehead's three stages of education.

The more complex a subject is, the more necessary it becomes to reduce its fundamental problems to the simplest possible concept.

In orthodontics there are actually just three fundamental problems. These must be thought of simultaneously in order to form a single, composite, mental picture.

1. The size of the teeth and the amount and disposition of the bone in which to accommodate them.

2. The relationship of the mandible to the maxilla most desirable for each particular individual.

3. The proportion and relationship of the teeth to the skull and facial features which will produce the most pleasing esthetic appearance.

Fig. 3.—Whitehead's third and highest stage of education. A satisfactory correlation of science, philosophy, and art. Creative imagination directed and controlled by classified ideas and relevant techniques.

Fig. 4.—Whitehead's second stage of education. The stultifying effects on orthodontics when science is insufficiently illumined by philosophy and art.

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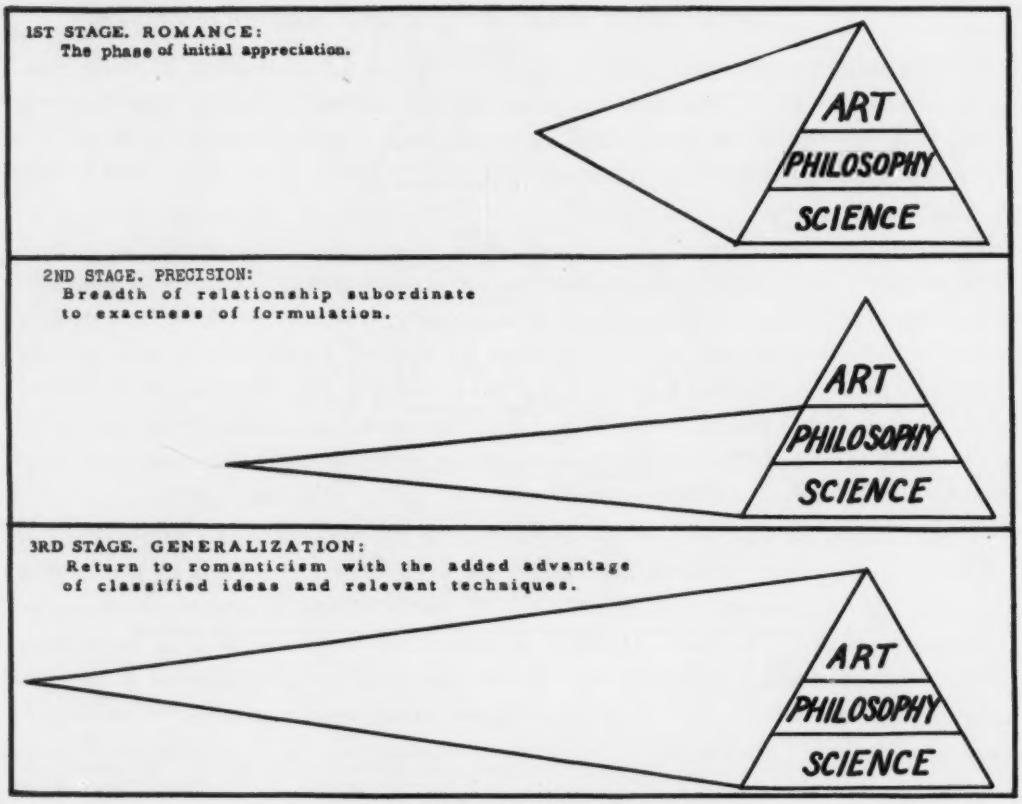

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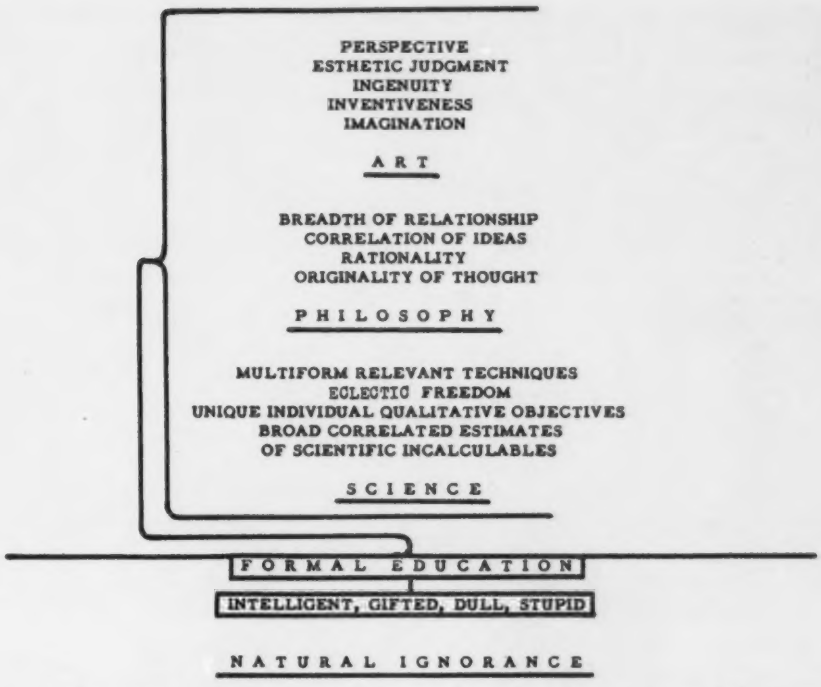

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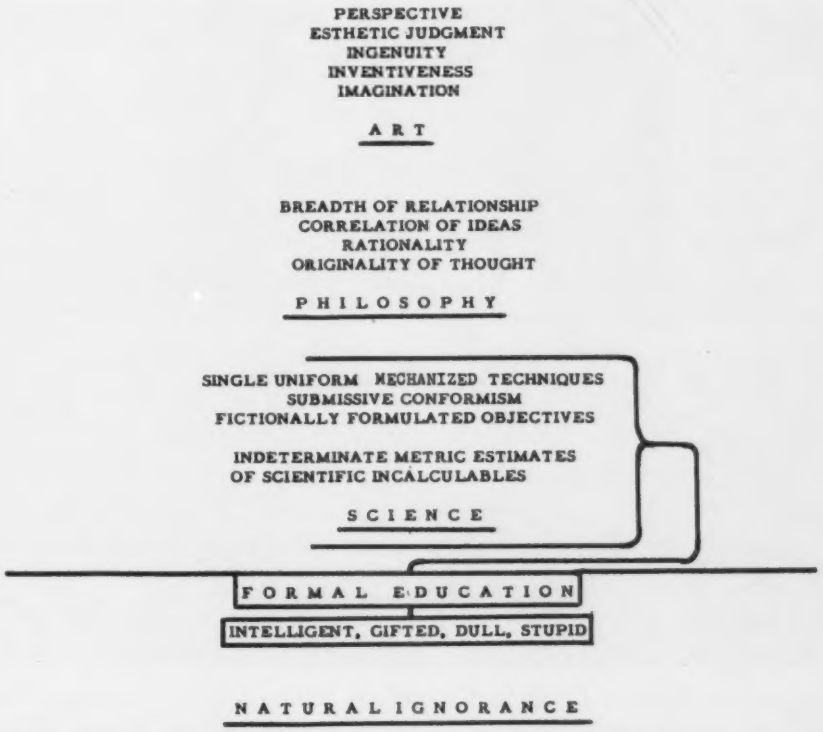


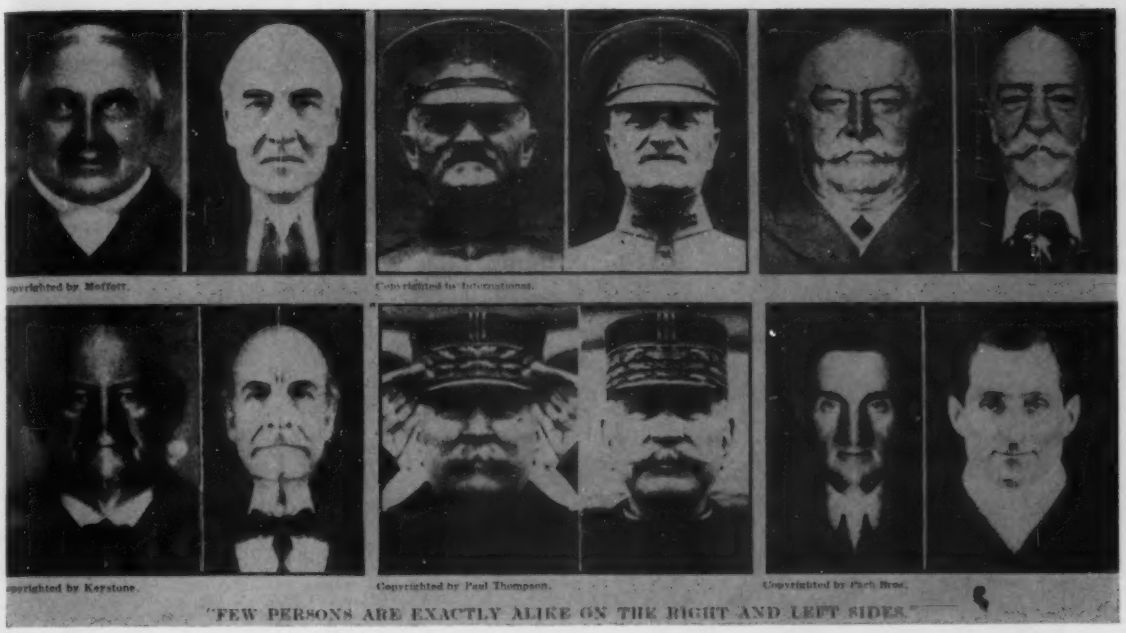
Fig. 4.—Whitehead's second stage of education. The stultifying effects on orthodontics when science is insufficiently illumined by philosophy and art.

An ideal occlusion and some variations are shown in Figs. 5, 6, 7, and 8.

If, figuratively speaking, we consider excellence in treatment as the ultimate goal of all orthodontic effort, it is very salutary to take stock of ourselves now and again to see how far we have progressed and how our results and equipment seem to compare with those of others. Thirty-five years or so of concentrated effort should teach almost any man what has proved indispensable to him and also what he may well discard, not only as excess baggage, but as a definite hindrance to progress. During the last fifty years, as any followers of orthodontics hardly need be told, the specialty has been in a constant

Fig. 5.—A satisfactory dental occlusion—structural balance, functional efficiency, and esthetic harmony. (From Jackson: D. Record, December, 1947.)

and active state of turmoil. A ceaseless array of new ideas, concepts, classifications, systems, and gadgets, many of them violently at variance with others, has paraded over the orthodontic horizon, starting with Angle's calamitous misconception that the objective of all orthodontic treatment was "ideal occlusion," with the wrecks of dental occlusions which it left in its wake, followed by the present indiscriminate "slaughter of the innocents" (90 per cent or more extraction of premolars in some practices), from the use of bands on twenty-four teeth to the use of no bands at all, from the panzer tactics of the edgewise appliance to the wishy-washy workings of the "on again off again" uses of the lingual arch. From these and many other ideas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"FEW PERSONS ARE EXACTLY ALIKE ON THE RIGHT AND LEFT SIDES."

Fig. 6.—These odd pairs of twins show the striking difference in the right and left sides of the faces of well-known people. The first picture in each case shows the right side combined with a reverse photo of itself to make a complete portrait, while the second picture shows the left side treated in the same way. "Such persons, in the view of some biologists, may be regarded as halves of twins, grown together." (From Jackson: INT. J. ORTHODONTIA, November, 1937.)

Fig. 7.—Compare this illustration for its total composite orthodontic diagnostic value with the present popular studies of "flat unilateral tracings of hemispheric cephalostatic radiographs." These latter have as much orientative accuracy, by comparison, as flat maps have compared to those on spherical atlases. The human skull is, in addition, notably asymmetrical. (From McCoy: Applied Orthodontics, Lea & Febiger.)

and gadgets too numerous to mention, every thinking orthodontist has had to salvage that which in his opinion has been most useful for his own clinical purposes.

This has finally ended up with two main conflicting philosophies and methods of procedure which are as diametrically opposed and incompatible as the ideologies of democracy and dictatorship. It is quite impossible to subscribe to the principles of both at the same time. There is no intention to straddle the issue, but to present as strongly as possible arguments totally in favor of a viewpoint which, in both concept and treatment, can be felt to be universal in character.

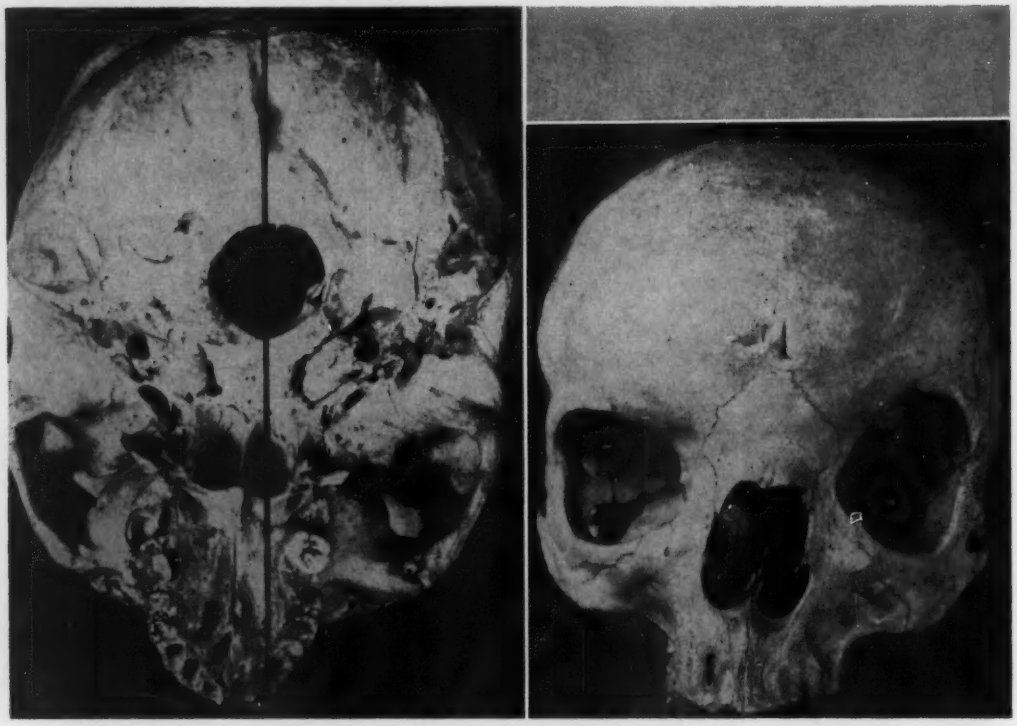


Fig. 8.—An example of extreme asymmetry in the human skull.

The opportunity to present a broader viewpoint clearly and simply, on a sound, scientific, philosophic, and artistic basis, is too tempting to pass up and if, by chance, this may lead the way to just one definite step forward in the progress of orthodontics, the purpose of this will have been accomplished.

POSITION OF OCCLUSAL PREFERENCE

The essence of any problem consists of knowing what to do, when to do it, and how to do it.

As in orthodontics we are dealing with living, sentient, human tissue which when under treatment is in a constant state of flux, it is mandatory to have instantly at one's command the means to glimpse at least an all-inclusive picture of a situation on which to base judgment. This is the crux of the matter, the pivotal point from which all creative planning radiates.

An orthodontist must, of necessity, "visualize" what he wants to do. He should be able to see clearly, from every angle and viewpoint, the exact status of a condition as it is in its *entirety* and be able to compare this with a more desirable arrangement which, in his imagination and judgment, is possible of attainment by means of orthodontic procedure.

An orthodontist may well ask what or where is this vantage point from which the whole panorama may be scanned. He will do well not only to think about this, but, if once accepted by him, to give it priority over every other single thought connected with the clinical practice of orthodontics.

For the everlasting benefit of orthodontics, Dr. Alfred P. Rogers was the fortunate man who indicated the nearest approach to this vantage point when he coined a term in connection with his contributions to myofunctional therapy. That it had anything to do with myofunctional therapy is purely incidental, whether Dr. Rogers realizes the far-reaching importance of his basic concept or not.

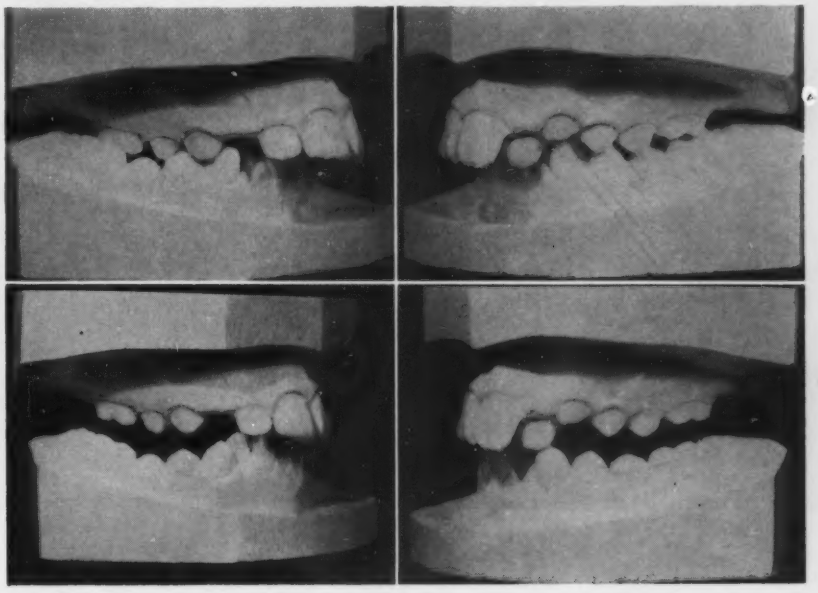
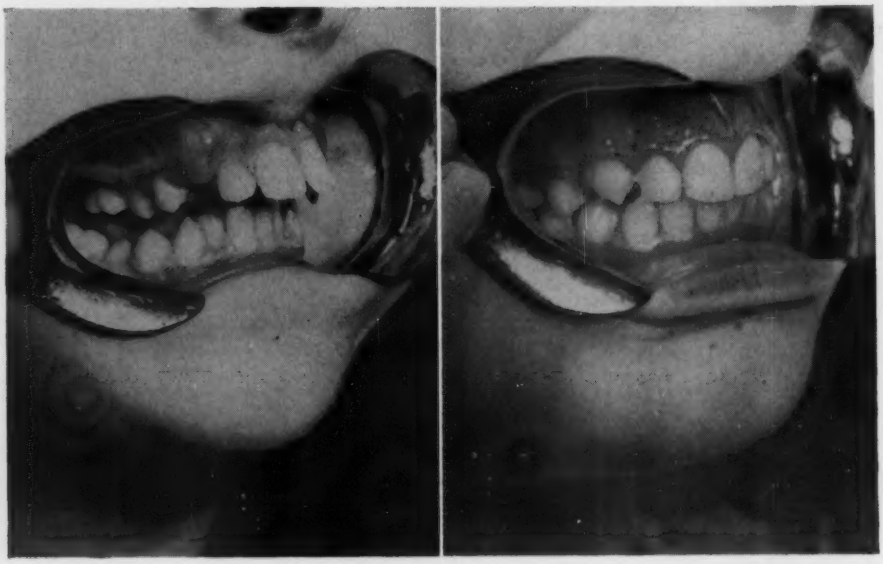


Fig. 9.—Comparing the position of natural occlusion with the position of "mechanical advantage" (Alfred P. Rogers) or "optimal occlusal relation" probably reduces to a single, composite, all-inclusive picture all the factors that must be taken into consideration in studying each individual case more quickly and accurately than any other means as yet devised. Models cannot convey any idea of what this may be and, if studied by themselves, may lead to some very erroneous decisions in estimating final objectives, as well as in the selection of the means best suited to obtain the best results. This can never be reduced to an exact science; therefore, the more the elements of art are employed, the better for all concerned.

Rogers' idea consisted of directing patients to place their jaws in the position which, visualizing the result at the end of treatment, seems the most desirable from the standpoint of function and esthetics. This is the simplest and most direct method of visualizing in their entirety the changes to be contemplated. He called this the position of "mechanical advantage." The term "optimal occlusal relation" might be more descriptive and specific. Whatever term is used, however, the important question is: "What means have we

to determine exactly what this position is?'' In actuality it is, of necessity, an arbitrary position based entirely on the judgment of the clinician. It can be one of many, but should again be the one which all the factors of the case indicate as the most desirable from the objective standpoint of structural balance, functional efficiency, and esthetic harmony in the finished result. A thousand different cases will show a thousand different pictures. A study of models alone conveys no idea of what this position may be and, per se, may be very misleading as to what should be done.

Plaster models are but artificial replicas of very circumscribed areas. These and cephalometric studies convey no idea of the dynamics of function of the individual from whom they are taken. Per se, they can be very misleading in conveying to the operator the actual facts upon which he should be informed. Orthodontics is concerned with combinations of form and functions from start to finish.



A. *B.*

Fig. 10.—*A*, Initial study of the position of "mechanical advantage" or "optimal occlusal relation." Three-dimensional bilateral study of structure, function, and esthetic proportions and relations. *B*, Results of treatment.

Obviously, the ideal way to gather the vital data necessary is from a personal study of the actual individual, both in repose and in function. In this way alone can a correct estimate be gathered of not only the gross factors of structural proportion, muscular tensions, and mental capacity and control, but also all the idiosyncrasies of function and personal interest of the patient so important to successful treatment.

This leads to the first general principle of treatment which is so far-reaching in its importance that its value can hardly be overestimated.

The first step in studying any type of malocclusion is to direct the patient to occlude the jaws in the position of optimum occlusal relation. This im-

mediately discloses, in the simplest and most comprehensive manner, the exact condition of affairs, and shows just what the interferences are which prevent the patient from occluding in that position habitually. At this point the true orthodontist should allow, as far as possible, the most complete freedom of action to his intellectual, artistic, and intuitive faculties, tempered at all times by his common sense, clinical experience, and observation.

These interferences may be malpositions of certain teeth in their horizontal relationship, their anteroposterior relationship, their vertical relationship, or any combination of these. In some cases the first immediate interference may be the simple torsoversion of one tooth. After this has been thoroughly studied, the first logical step in treatment should be to devise means to remove the interference, and this should be accomplished with appliances best suited to the peculiar requirements of that particular individual case, and at that particular moment. In the natural order of things, concepts come first, general principles of treatment second, a consideration of the factors involved third and, finally, the type of appliance to be used for the particular case. The great ingenuity of orthodontists has produced a vast variety of appliances, and it is the job of the orthodontist to select from this material the ones best suited not only to the particular case he is going to treat, but to the particular problem with which he is confronted.

In making the changes which the orthodontist, in his judgment, may think desirable, he has at his command four means to produce tissue readjustments.

Two of these means take full advantage of Nature's natural unaided efforts at anatomic and physiologic readjustments. The other two means are extraneous and artificial mechanical forces.

1. Surgical interference, which includes osteotomies and ostectomies in extreme cases and that most controversial of all orthodontic subjects—the extraction of teeth.

2. Natural tissue readjustments constantly operative throughout life due to growth, development, and functional changes, and particularly noticeable and active after the extraction of teeth.

3. Induced tissue readjustments, either by unhampered volitional functional muscular efforts or induced by passive mechanical interferences, such as bite planes, guide planes, cribs, etc.

4. Artificial mechanical pressures, produced by orthodontic appliances of all kinds and descriptions.

It stands to reason that in the course of treatment the less the forces of Nature are interfered with by mechanical appliances, and the more the tissues can be altered by natural readjustments and induced functional changes, the more logical and natural is the treatment. This basic concept of treatment is diametrically at variance with the principles and methods employed in systems where all the teeth are banded, Nature is hamstrung, and all the changes are subject to the skill of the operator and the mechanical limitations of a specific appliance.

It has been said that anyone who has grasped a "principle" or "method of approach" which is universal in character has in his hands the only weapon applicable to infinite variation. Techniques are mere servants to principle. When anyone takes over the technique of a predecessor without sharing the vision which animated it, he takes over a mental body but loses its immortal soul.

Orthodontic appliances are the activating mechanical means whereby orthodontists alter the anatomic relations, functional activities, and esthetic proportions of the teeth and surrounding tissues.

The judgment exercised in their selection, as to the place and time of their uses, is the determining factor and final expression of the orthodontist's philosophic, scientific, and artistic concept of the subject, because in practically all cases they are the indispensable elements necessary in attaining the results he wishes to produce.

It also stands to reason that the simpler the appliances and the more clearly the operator can see for himself at each successive step in treatment the actual changes which are taking place, the more likely he is to save himself from the pitfalls into which time-consuming, mentally confusing, complicated appliances are likely to enmesh him. The acid test of an artist is the breadth of concept and the simplicity and directness with which he can attain his practical objectives.

Simple appliances, devised on sound mechanical principles and in harmony with the biologic laws of Nature, which insure stable anchorage for all the teeth it is desirable not to move, pitted with gentle continuous pressures against those it is desirable to move, constitute, in a large percentage of cases, an ideal setup for the changes which it is possible and desirable to make.

At the present moment, orthodontics is faced with a problem of the most far-reaching importance for its future. At the San Francisco meeting of the American Association of Orthodontists in 1955, a motion was passed making it mandatory that, to qualify for membership in the A.A.O., each candidate should have at least 1,500 hours of postgraduate instruction. No one will possibly argue the point that it is enormously to the benefit of orthodontics that the standard for an orthodontist should be raised to the highest level. The final qualifications for an orthodontist, however, are that he should not only be an individual of the highest standard ethically and educationally, but that he should show evidence that he knows enough of the science, philosophy, and art of orthodontics to be able to treat patients successfully. The only way to prove his practical efficiency is by examination, after sufficient time has elapsed to have enough cases to show the results of his work. It makes not the slightest difference where he has acquired his knowledge. The intelligent man can acquire it by self-study, whereas neither 1,500 nor 15,000 hours of postgraduate instruction can possibly make an orthodontist out of a man who does not have the capacity to acquire a correct proportion of science, philosophy, and art in his make-up. At the present time, 1,500 hours in some postgraduate schools are enough to ruin some men forever as far as becoming orthodontists is concerned, because they have stamped out the last shred of original genius they may have possessed.

To eliminate from membership hand-picked men who have spent years in their development, in association with men of distinction in the profession, is to deprive the association of the cream of the crop. Let them all, however, pass a very satisfactory examination after a sufficient period has elapsed.

In a recent article regarding college degrees, there appeared a few remarks which are worthy of consideration:

"Conceit about a college degree is one of the surest evidences of an inferior mentality. That does not mean that an education is not a good thing to have; it is. But if it does not succeed in giving a student some touch of wisdom, it has failed in its purpose. It is sheer foolishness for a man to say, 'I went through college and you didn't; therefore my judgments are better than yours.'

"The very best thing that a college education can do for a student—if indeed it can do it—is to teach him how little he knows; what a staggering mountainous inexpressible amount he does not know. A college degree proves hardly any more than that a student has managed to memorize a certain amount of information. Whether he has understood it is another matter. Whether he is intelligent, time will tell. We all know that many men rise to greatness with what appeared to be very little equipment. But those men worked; those men thought; those men applied themselves. And other men with the best preparation that Society can give them, manage to make preposterous failures of themselves."

For many years the basic ideas which are presented in this article have found frequent expression in a great many case reports covering not only the usual typical cases of malocclusion, but including many unusual and extreme variations. These extreme cases have purposely been included to demonstrate a method of analysis and diagnosis, together with *relevant* techniques for their successful treatment. These have included a wide variety of appliances, including a number of cases in which no bands at all have been employed (but in any case, the least number possible), and allowing at all times greatest possible freedom for function and natural tissue readjustments to do their utmost without mechanical interference. As these have been presented with the utmost frankness and sincerity, the methods employed are open for anyone to criticize and to suggest means which would be more in keeping with correct treatment.

As the committee which has made the awards for the prize essays for the last two years are so enthusiastically in favor of the unilateral, hemispheric method of cephalometric approach, and as the material which the two prize essays covered occupied a large percentage of the valuable space of the AMERICAN JOURNAL OF ORTHODONTICS in the numbers in which they were published, it would be very interesting and enlightening if the members of the committee would, themselves, present a series of case reports. These case reports should include wide variations, among which should be at least several cases with great disproportion and malrelations of the opposite sides. This would make it necessary for any cephalometric approach to include at least both lateral halves.

In concluding, it might be well to consider again a few thoughts from Professor Whitehead:

"We live perforce by half-truths and go along fairly well as long as we do not mistake them for whole-truths, but when we do so mistake them, they raise the devil with us. Dogmatic thought plays the devil with science. *When we have grasped a conceptual idea which is more comprehensive in its perspective than any that have preceded it, it may be sufficient in itself to alter a whole system procedures which may have become sacrosant by tradition.*"

"Aristotle founded modern Science. His divisions of observed phenomena which he supposed to be whole truths have been ascertained to be no more than half-truths. And yet, if we are to have science, what Aristotle did was exactly the right thing to do. In science we must have order, and for that you must isolate certain types of order for observation. But again with science as with philosophy, the subject cannot be understood without studying it in relation to the life which surrounds it."

"Art is the imposing of a pattern on experience, and our esthetic enjoyment in recognition of the pattern."

"Some ideas are popularized by people who only imperfectly understand them, who are incapable of the great effort required to grasp them in their relationship to larger truths and who, therefore, assign to them a prominence out of all proportion to their true importance."

"It is the rigid dogma that destroys truth; and please notice my emphasis is not on the dogma but on the rigidity."

"Aristotle invented science but destroyed Philosophy."

Aristotle himself has said: "While individually we contribute little or nothing to the truth, by the union of all a considerable amount is amassed."

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1218 MEDICAL ARTS BLDG.

GROWTH AT FACIAL SUTURES

J. H. Scott, M.D., Belfast, Ireland

INTRODUCTION

AT THE present time much work is being carried out on the methods, sites, and patterns of growth in the human face.[1-3, 5] This knowledge is of fundamental importance in the understanding of the etiology of malocclusions and facial deformities. Certain conclusions, however, are of doubtful validity, as they appear to be based on an inadequate study of the methods of suture growth and the precise arrangements of the sutures in the facial skeleton. It is the purpose of this article to investigate and discuss these matters.

GROWTH AT SUTURES

The structure of growing and adult sutures has been described by Pritchard and his associates.[6] They have shown that a typical facial suture (Fig. 1) is composed of five layers of tissue between the bony margins of the suture. These layers are:

1. A cellular layer belonging to each bony unit.
2. A fibrous layer continuous with the fibrous periosteum covering each bone.
3. A central layer, containing blood vessels and uniting strands of collagenous fibers.

Growth at a suture takes place at each of the cellular (cambial) layers and may differ in its intensity and amount for each of the bones. The relationship of the bones to one another, at a suture may be (1) an edge-to-edge relationship (Fig. 2) or (2) an overlapping relationship (Fig. 3).

If the relationship is of the edge-to-edge variety, growth at the suture is correlated with separation of the bony elements. Growth may take place at the sutural surface of one or the other of the bones or at both. The process may or may not involve a change in position of the suture (Fig. 2). It is important, moreover, to know whether or not the suture changes position, as certain sutures or points on sutures are often taken as "fixed points" in superimposing cephalograms in serial studies of facial growth.

If, however, the relationship is of the overlapping variety, growth at the suture need not involve separation of the bones. With surface deposition, one bone migrates over the surface of the other and the position of the suture

From the Anatomy Department, Queen's University.

Fig. 1.—Structure of a growing suture. *1*, Fibrous layer of periosteum; *2*, cellular layer of periosteum; *3*, new bone; *4*, old bone. *a*, Cellular (cambial) layer of suture (region of bone growth); *b*, fibrous layer of suture; *c*, central fibrovascular layer of suture.

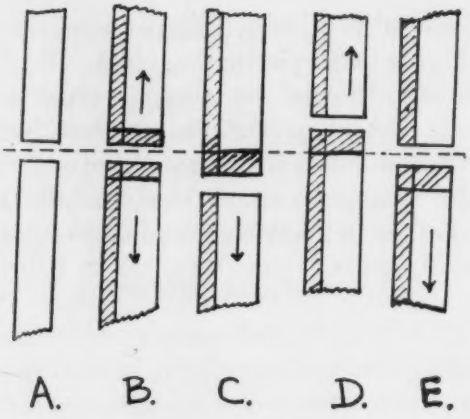

Fig. 2.—Growth at an edge-to-edge suture; cross-hatching shows new bone deposition. *B*, Bone is deposited at each sutural element; the bones move apart but position of the suture remains unaltered. *C* and *D*, Bone is deposited at one or the other of bony elements and one of the bones moves so that position of the suture is altered. *E*, Bone deposited at one bone only, upper bone is fixed and lower bone moves downward while position of suture remains unaltered.

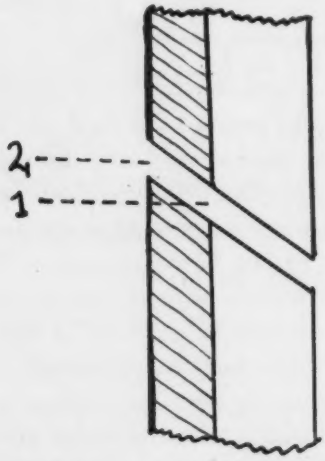

Fig. 3.—Growth at an overlapping suture. With deposition of bone on the surface, but not in the suture, one bone migrates upward over the surface of the other and the surface position of the suture is altered. *1*, Original position; *2*, new position.

as seen from the surface changes. Once again, care must be taken to estimate the extent of this method of growth in using "fixed points" for superimposition purposes.

Growth at sutures does not in itself produce separation of the bones at the suture. This is brought about by the growth of other organs such as the cartilage of the chondrocranial and chondrofacial skeleton, the brain, the eyeballs, and the tongue.[8]

FACIAL SUTURE SYSTEMS

The sutures of the craniofacial skeleton can be grouped into a number of suture systems. The sutures making up each system are so arranged as to permit growth in a certain direction. The suture systems in the human face are:

1. The *sagittal suture system,* made up of the mid-palatal, intermaxillary, internasal, and metopic sutures with the mandibular symphysis. It is complete in fetal life and at birth, and permits growth in width of the facial skeleton. At the end of the first year, the mandibular symphysis and the metopic suture in the majority of persons have united, and the sagittal suture system is no longer complete. It is doubtful whether any further growth takes place in the mid-palatal suture after this time. By the end of the first year, the distance between the two orbital cavities across the bridge of the nose has reached adult dimensions in many children.

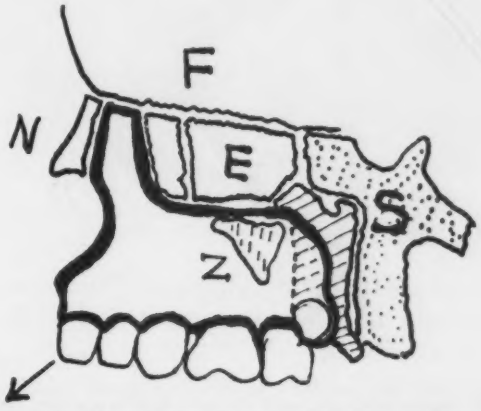

Fig. 4.—Diagram to show the position of the maxillary and craniofacial suture systems. Note relationships of frontomaxillary to the frontonasal suture and of the posterior border of the maxilla to the palatine bone and pterygoid plates. *N,* Nasal bone; *E,* ethmoid (orbital plate); *S,* sphenoid (including pterygoid plates); *Z,* zygomatic process of maxilla.

2. *The maxillary suture system,* made up of the sutures separating the maxilla from the nasal, frontal, lacrimal, facial ethmoid, palatine, zygomatic, and vomer bones (Fig. 4). This system consists of two limbs, a horizontal limb at the medial and lateral walls of the orbital cavity (including the vomerine-maxillary junction of the nasal septum), and a vertical limb in the pterygopalatine fossa (between the maxillary and palatine bones).

3. The *craniofacial suture system,* made up of the supramaxillary and retromaxillary facial bones on one side (nasal, lacrimal, facial ethmoid, pala-

tine, zygomatic, and vomer) and the frontal, mesethmoid (perpendicular plate), sphenoid (with pterygoid plates), and temporal bones of the cranium on the other (Fig. 4). This system, likewise, consists of (1) a horizontal segment running along the medial and lateral walls of the orbital cavity and including the vomeroethmoidal and vomerosphenoidal junctions in the nasal septum and (2) a vertical segment in the pterygopalatine fossa (between the vertical plate and tuberosity of the palatine and pterygoid plates) and including the suture of the zygomatic arch. Union takes place between the facial ethmoid and the perpendicular plate (a cranial bone) across the cribriform plate between 3 and 5 years of age,[9] and it is probable that after this time growth ceases in this suture system.

The maxillary and craniofacial suture systems are so arranged as to permit downward and forward growth of the upper facial skeleton and especially of the maxilla.

MAXILLARY SUTURES

More detailed attention in regard to certain of the maxillary sutures is necessary and will now be considered.

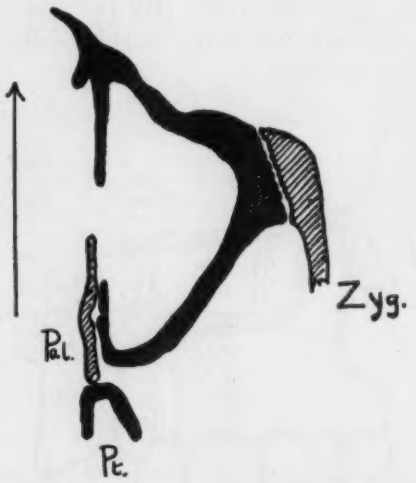

Fig. 5.—Diagram to show the position of the zygomatic and palatine bones relative to the maxilla as seen in a transverse section. Arrow indicates position of nasal septum and the direction of growth of the maxilla in early childhood. *Pal.*, Palatine bone (vertical plate); *Pt.*, pterygoid plates; *Zyg.*, zygomatic bone.

Fig. 5 shows in a diagrammatic manner the relationship of the palatine and zygomatic bones to the maxilla as seen in a horizontal (transverse) section of the face. It will be seen that the vertical plate of the palatine bone, which forms part of the side wall of the nasal cavity, overlaps the back part of the nasal surface of the maxilla. The two overlapping bones between them form the boundaries of the greater palatine canal leading from the pterygopalatine fossa above to the greater palatine foramen on the palate below.

The zygomatic bone articulates with the surface of the zygomatic process of the maxilla which faces outward and slightly forward.

The relationship of the palatine and maxillary bones to the maxilla is such as to permit the maxilla to be thrust downward and forward between them, but growth at the palatine and zygomatic sutures (more accurately "surfaces") will not, in itself, produce this movement. The maxilla is held between the zygomatic and palatine bones as between two hands. The only method whereby it can be moved downward and forward between them is by growth of the cartilage of the nasal septum.

It is often stated that growth at the frontomaxillary suture thrusts the maxilla downward and forward from the cranium (frontal bone). It has been shown that this suture is part of the maxillary suture system and growth will take place at this site for as long as the maxilla is being thrust downward and forward by the septal cartilage. It must be made clear, however, that the behavior of the nasion (at the frontonasal suture as seen in profile view on lateral cephalograms) cannot be used as direct evidence of growth changes at

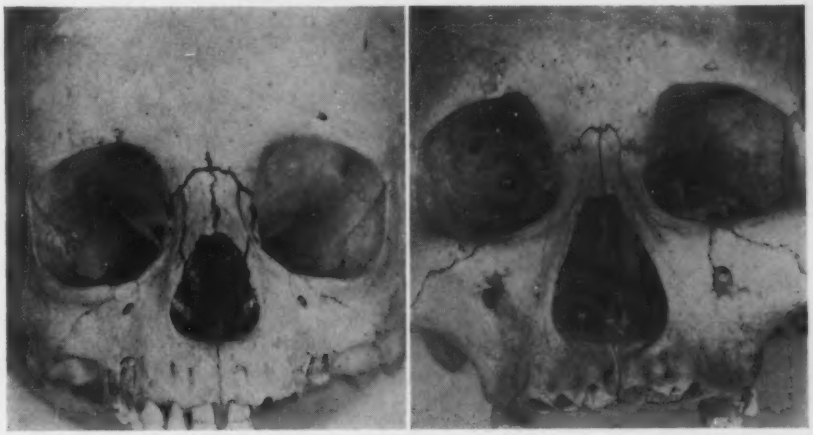

Fig. 6.—Frontonasal and frontomaxillary sutures in a child of 6 years and in an adult. Note the higher position of the frontonasal suture in the adult.

the frontomaxillary suture. The suture between the nasal and frontal bones is of the overlapping variety and nasion ascends on the frontal bone with age. This can be shown as follows:

1. Nasion is usually closer to the upper orbital margin in adult skulls than in the skulls of children.
2. The frontonasal suture in adults is usually at a higher level than the frontomaxillary suture. In children, the two sutures are at about the same level (Fig. 6).
3. In sagittal sections, the direction of the frontonasal suture is seen to run upward and outward for some distance before it turns forward. Nasion in the adult is usually some distance above the level of the roof of the nasal cavity (cribriform plate). In children it is at about the same level (Fig. 7).

Therefore, the position of nasion cannot be taken as evidence of separation of the maxillary and frontal bones and it must be used with care as a "fixed" point in the superimposition of serial cephalograms.

Investigators sometimes treat changes at the posterior surface of the maxilla as seen in lateral cephalograms as evidence of sutural growth. Diamond[4] pointed out that the posterior surface of the maxilla grows into the pterygopalatine fossa throughout childhood and adolescence and does not become buttressed against the pterygoid processes until adulthood. Furthermore, the alveolar bulb of the maxilla projects backward on the outer side of the lateral pterygoid plate and undergoes a process of alternating expansion and contraction as the molar teeth develop within it and move forward into

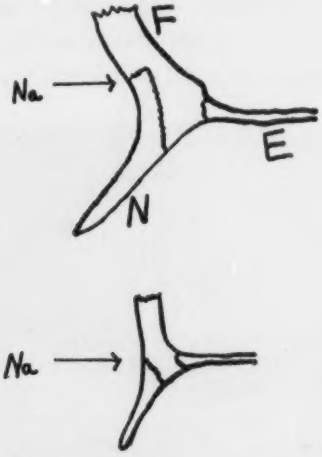

Fig. 7.—Diagram of a sagittal section through the front of the nasal cavity to show the upward migration of nasion relative to the roof of the nasal cavity. *N*, Nasal bone; *F*, frontal bone; *E*, ethmoid; *Na*, nasion.

occlusion.[7] Therefore, growth at the posterior border of the maxilla does not necessarily involve growth at the deeper palatomaxillary or palatopterygoid sutures.

SUMMARY

Each suture has two growth sites, one for each of the bony elements. Growth at a suture may or may not involve a change in position of the suture and may or may not involve separation of the bones. During early childhood the maxilla is thrust downward and forward from the anterior segment of the cranial base, but this process of bodily movement of the bone is not brought about by growth in the sutures. The separating force is provided by growth of the septal cartilage and the orbital contents. The position of nasion and the posterior border of the maxilla, as seen in lateral cephalograms, cannot be used as direct evidence of suture growth with separation of the bones in the analysis of growth changes in the maxilla.

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Editorial

BROCHURE BY A. LE ROY JOHNSON

AN INTERESTING booklet entitled *Dentistry As I See It Today** has recently come off the press. The author is A. LeRoy Johnson, D.M.D., former dean of Harvard School of Dental Medicine and former professor of orthodontics at the University of Michigan, University of Pennsylvania, and Tufts College Dental School. With the support of the Rockefeller Foundation, the Markle Foundation, and the Carnegie Corporation, Dr. Johnson visited many universities in the United States and Canada to discuss the subject of dental education with deans, teachers, and heads of universities; that experience obviously inspired this book. Among other things, Dr. Johnson makes some interesting observations about the orthodontic field. These observations give the impression that orthodontics started as a specialty about fifty years ago, and that dentists who agreed to sever all connections with other departments of dental practice were admitted to the specialty. He points out that at that time the extraction of teeth in an effort to make room in the dental arch was taboo and, if done at all, was done with "tongue in cheek." He reiterates that the over-all former perspective of orthodontics was purely mechanical arts, perfection, and manipulation.

The thing of real interest to orthodontists, however, is the comment on genetics, derived from his experience in this field. Dr. Johnson, as a result of his research experience, has given this subject a great deal of attention. He took an active part in the well-known Stockard research at the Cornell Experimental Farm, where he recorded and studied over 1,500 canine skulls obtained from the cross-breeding of various types of pure-bred dogs with contrasting types of skulls and dental equipment. He contends that the orthodontist faces a difficult situation in that he is trained in method but is lacking in acquaintance with the physiologic processes involved and that the quality of service reflects his reaction to trial-and-error experiences. He points out that defective alveolar structure is characteristic of certain dog breeds, particularly among the short-snout mandibular undershot types. He calls attention to three littermates (F2 experiment), generation Dachshund by Boston terrier from the same strain. One had the normal canine dentition, one had the usual deviations of the Boston terrier, and one was entirely without alveolar bone in the maxillary incisal region. The generation previous to that, however, followed the pattern of the long-muzzled Dachshund type and the diversity

*Published by Little, Brown & Company, Boston, Mass.

in parentage revealed itself in the second generation. Another interesting point is that the forms of the maxilla, mandible, and dentition are markedly independent and that, as for the skull and face, in parts some are dominant and some recessive and, in transmission from one generation to another, new combinations of genes result in variations of form. Johnson reasons, therefore, that a rational interpretation of malocclusion of the teeth stems from knowledge of the biologic sciences and that the resultant organism is created by the interaction of germinal substance along with environmental influences. The over-all point is made of the inevitability of infinite variation in structural forms and the fact that the statement of gauge of normal form is not a theoretical idea, as once considered, and function is pretty much of a fiction. Anyway, while Dr. Johnson does not say so, one who reads his observations easily gets the impression that there is very little doubt that those who understand genes and chromosomes would have little difficulty in bringing about Angle Class III or Class II occlusion in the canine family with regularity by the crossbreeding of a few generations and that in time they probably could fix even the triangulation of the roots of incisor teeth according to the so-called basal bone.

If the profuse mail directed to the AMERICAN JOURNAL OF ORTHODONTICS, particularly from Europe, Australia, and the United States, is any criterion, it is revealed that there is a sharp upsurge of interest among orthodontists regarding the first fifty years of the history of their specialty. Perhaps part of that may be due to the fact that orthodontics has passed its fifty-year anniversary, pinpointing the spot where the subject was introduced as the first important specialty of dentistry in the United States. The specialty has made such rapid growth, particularly in the number of dentists who have decided to devote their entire time to this subject, that more and more workers now manifest great interest in the first fifty years of the record. During this fifty years there appeared so many methods and ideas that we are reminded of the comment of the late H. L. Menken: "We must respect the other fellow's pet theme, but only in the sense and to the extent that we respect his theory that his wife is beautiful and his children smart." There was a time when LeRoy Johnson's ideas were regarded as somewhat of another "pet theme." Time proved, however, that he was more the voice in the wilderness contending that if orthodontics is to move ahead as a health service, its basic thinking must give heed to the biologic sciences and throw off the yoke of its traditional major interest—mechanical arts—and that where the relation of teeth and jaws *ultimately remains* in the skull subsequent to treatment depends more upon the biologic sciences than it does on any mechanical skills that may shift their positions on the bone structure.

Dr. Johnson, now retired and living in Great Barrington, Massachusetts, deserves much credit for having done much of the pioneer work in alerting the new specialty of dentistry to the urgency of getting more in step with the problem at hand. He contributed much in that first fifty years and his

brochure now reflects some of his orthodontic thinking and background of teaching, research, and clinical practice. Orthodontics and dentistry both are still in need of a comprehensive perspective of the problems at hand. Dr. Johnson was one of the first to grasp orthodontics' coat lapels and say, "Forget worshipping at the shrine of appliances alone if you expect to make a real science of your subject."

H. C. P.

In Memoriam

JOSEPH H. WILLIAMS

1882—1956

JOSEPH H. WILLIAMS, St. Louis orthodontist, died Jan. 25, 1956, at the age of 73 years.

Dr. Williams was born in Fenton, Missouri, on Sept. 5, 1882. He was graduated from St. Louis University School of Dentistry in 1911, and practiced general dentistry in Webster Groves, Missouri, until 1922, when he limited his practice to orthodontics. In 1932 he moved his office to the Beaumont Medical Building in St. Louis, where he practiced until the time of his death.

Dr. Williams served on the faculty of St. Louis University School of Dentistry from 1933 to 1944. He was president of the St. Louis Society of Dental Science in 1926 and of the St. Louis Dental Society in 1934. In 1938 he was Supreme Grand Master of Delta Sigma Delta fraternity. He had long been a member of the American Association of Orthodontists and was a past-president of the Central Section of the A.A.O. He was a member of Omicron Kappa Upsilon and a fellow of the American College of Dentists. Dr. Williams belonged to the Masonic Lodge and was a member of the Webster Groves Presbyterian Church.

Dr. Williams was well known among the members of the A.A.O. and also as a former Grand Master of Delta Sigma Delta. He traveled a great deal throughout the United States in the pursuit of his professional activities. He will be greatly missed as one who contributed much of his time and energies to the activities of dentistry throughout his life.

Dr. Williams is survived by his wife, Maud, and two sisters.

Department of Orthodontic Abstracts and Reviews

Edited by

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All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Role of Physical Anthropology in the Field of Human Identification. *Science* **122**: 883-884, November 4, 1955.

On Sept. 6 to 9, 1955, a group of physical anthropologists assembled in Washington, probably for the first time in the history of their science, to discuss with others the subject used as the title of this report.

T. D. Stewart (U.S. National Museum) gave a keynote account of anthropologic participation in medicolegal matters. He emphasized that the problems of reconstructing the characteristics of the individual from bony and other remains have always been at the core of traditional anthropologic activity. He pointed out also that, although anthropologists have long been interested in fingerprints and blood groups, and these are largely responsible for direct individual identifications, the procedures involved are now standardized.

The first panel was led by W. M. Krogman (University of Pennsylvania). Their topic was "Physical Anthropologists as Specialists in Human Identification." In this connection, a point of considerable concern to the anthropologists and those they serve is the fact that several identification standards are in existence. For example, age standards vary for single events in skeletal ossification, and the range of variation for the time that these events occur is not well established. This means that two anthropologists may differ in their opinions on the age of a skeleton.

The discussion of the second subject, "Identification of Small Remnants of the Human Body," was led by William S. Laughlin (University of Wisconsin).

Of major concern was the development of methods of identifying bone, tooth enamel, and other tissues lacking in recognizable gross morphology. For example, even after the detailed configurations of the ridges and sulci of the skin have been destroyed, fingerprints may be developed from microscopic sections showing the arrangement of the ducts of the sweat glands. Suggested, among other things, as promising for further study in differentiating human and animal bones was a comparison of bone fats and of bone collagens. Evidence was presented that burned bones bear witness to whether or not the heat had been applied when they were flesh covered.

The third panel began to consider specific determinations that can be made on the skeleton as a whole or on its larger parts. A discussion of "Sex and Age" was led by T. D. Stewart.

The role of function in determining sex from the skeleton was discussed at length. Thieme demonstrated the application of the principle of discriminant

function in sex identification. By utilizing seven skeletal characters, he showed that sex may be determined in 98 per cent of cases. The errors resulting from this sorting method were found usually to be in the identification of females with male characters. Among the points developed regarding age estimation from the skeleton was the greater reliability of tooth calcification as compared with ossification of the wrist bones.

The fourth panel continued with "Reconstruction of Stature, Body Build, and Facial Features." Further improvement in the estimation of stature from lengths of long bones was shown to depend on analyses of body types. On the other hand, estimation of body weight from bones was shown to be useful primarily for lean body mass. As for facial reconstructions, Krogman presented a new technique based on the concept of the "ideal face" as developed from orthodontic stereographs. Also, the panel discussed the question of using existing x-ray pictures of such parts as the frontal air sinuses or the jaws for individual identification (like fingerprints, high in reliability), together with the need for caution against exposure to unnecessary irradiation and for uniformity of technical factors.

The Physiology of Mastication and Deglutition Illustrated by Means of Cinefluorography. By M. Klatsky, *Paradontologie* 9: 139-143, December, 1955.

Three subjects were employed. The first was a young woman, 20 years of age, with a well-developed masticatory apparatus and a full complement of good, properly occluding teeth.

Taking into consideration the dangers involved in exposing the same person to x-ray radiation for too long a period, not more than two five-second exposures were given at one time. Then intervals of at least several days passed before the next exposures were made.

The film begins with a photographic view of the anatomic parts of the human masticatory organs involved in mastication. This is followed by a demonstration of the up-and-down, forward-and-backward, and side-to-side movements of the mandible. These movements are made possible by the complex double joint of the temporomandibular articulation. The condylar movements in the glenoid fossa are clearly brought into view in the cinefluorographic part.

Swallowing a Liquid.—In this instance, the liquid was milk mixed with a radiopaque substance, barium, to make it more distinctly visible in the picture. (Barium was mixed with all the other foods experimented with in the cinefluorographic parts of the film.) There is no mastication required in drinking a liquid; it quickly passes through the esophagus to the stomach. The up-and-down movements of the hyoid bone are clearly visible during the act of deglutition.

The following solid foods are shown in the motion picture:

Soft bread or cake, although a solid, stimulates very little mastication. The food is simply taken into the mouth, receives a general squash between the teeth or between the dorsum of the tongue and the hard palate, and is then swallowed.

Orange. This is also a soft food, but the pulp of an orange is fibrous. Some chewing is required before it can be swallowed. The sensitive tongue will not permit the fibrous part to pass to the stomach until it is properly comminuted. Therefore, the pulp of an orange stimulates mastication to some extent.

Hard bread. Hard bread is a good stimulant to mastication. When chewing a slice of well-baked bread, it is the coarse, resistant crust that causes hard and prolonged chewing, in contrast to soft bread which is ineffective as a masticatory stimulant.

Celery. A vegetable such as celery provides much stimulation to its marked hardness and fibrosity in the raw state. This effect is lost when the food is subjected to the softening influence of cooking.

Steak. Meat requires prolonged chewing before it can be swallowed, because it is fibrous. Steak not only requires longer chewing, but also offers great resistance to the teeth and needs more forceful chewing. It is an excellent masticatory stimulant.

Dry corn. The degree of hardness of a food must not exceed a certain optimum state. When it surpasses this optimum, mastication is hampered and retarded. Therefore, hard, dry corn or raw rice is unsuitable for mastication and is not taken for food. We experimented with this substance because many researchers use it in animal experimentation.

The last two scenes of the film show two other subjects. One is a man, 50 years of age, who lost his lower posterior teeth. Chewing is abnormal, the tongue constantly tossing the food to the anterior part of the mouth for the incisors and cuspids to do the grinding and chewing which is normally performed by the premolars and molars. The third subject was a woman, 40 years of age, who also lost her lower posterior teeth, but these were replaced by a partial denture, in which case function was more or less normal.

Modification of Skull and Jaw Architecture Following Removal of the Masseter Muscle in the Rat. By Sidney L. Horowitz and Harry H. Shapiro, *Am. J. Phys. Anthropol.* **13**: 301-308, June, 1955.

SUMMARY AND CONCLUSIONS

"1. The masseter muscle was surgically excised in a number of one-month-old Sherman strain rats.

"2. Unilateral removal of the masseter results in severe skeletal alterations in the skull, jaws, and dental arches.

"3. The rostrum deviates to the unoperated side; the mandible on that side becomes warped in an inferior and lateral direction.

"4. Molar tooth occlusion is affected on both sides of the mouth, an 'open bite' resulting on the side of operation.

"5. No marked gross or dental changes follow bilateral removal of the masseter muscle.

"6. Architectural variations in the cranio-facial skeleton following unilateral removal of the masseter muscle in the rat are probably the result of functional imbalance in the remaining masticatory muscles."

Bone and Bones. Fundamentals of Bone Biology. By Joseph P. Weinmann, M.D., College of Dentistry, University of Illinois, and Harry Sicher, M.D., D.Sc., School of Dentistry, Loyola University, Chicago, Illinois. St. Louis, 1955, The C. V. Mosby Company, 508 pages; 302 illustrations. Price, $13.75.

In this second edition of a text which met with wide acclaim when first published, the authors have outlined more fully, for the first time, the hypo-

thetic mechanism of bone formation and resorption. They also present a basic concept of skeletal growth, especially growth of the skull.

Part I deals with the normal structure and growth of bone and bones. Here the authors describe the structural elements and arrangement of bone tissue. An account is presented of osteoblastic and osteoclastic action, which will prove interesting and enlightening, especially to orthodontists and periodontists. The development and regeneration of bone are clearly described and illustrated. Bone tissue and bones as organs are here presented in a manner understandable to the practitioner who is not essentially an histologist.

In describing growth of the skull, Weinmann and Sicher give due attention to orthodontic findings and considerations. They point out that third molar impaction is enhanced by the fact that "the third molars erupt at a time when the general growth of the body and that of the jaws is nearly completed."

Part II, "Pathology of Bone and Bones," includes the discussion of developmental disturbances and adaptational deformities. The influence of the endocrines and vitamins on bone and bones is mentioned. In the chapter on the effect of minerals on bone and bones, an account is presented of calcium and phosphorus metabolism and on the effects of fluorine on the organs. An interesting description is presented of the healing of bones and of healing after tooth extractions. The steps in the healing of an empty socket are given in succinct order. Various pathologic conditions of bones, including tumors and idiopathic bone diseases, are presented.

An extensive and significant bibliography is included. Throughout, the authors have reviewed the modern concepts of bone formation and bone pathology.

J. A. Salzmann.

News and Notes

Central Section of the American Association of Orthodontists

The next meeting of the Central Section of the American Association of Orthodontists will be held at the Edgewater Beach Hotel, Chicago, Illinois, Oct. 1 and 2, 1956.

Pacific Coast Society of Orthodontists

The Pacific Coast Society of Orthodontics will hold its next meeting Aug. 13, 14, and 15, 1956, at the Benjamin Franklin Hotel, Seattle, Washington.

Southern Society of Orthodontists

Under the leadership of Dr. William M. Jarrett, president, the thirty-fifth annual meeting of the Southern Society of Orthodontists will be held at the Greenbrier Hotel at White Sulphur Springs, West Virginia, Aug. 19 and 20, 1956.

The committee consists of Drs. Ralph Rudolph, Chairman, Charles Hopkins, Carl A. Laughlin, Hubert E. Martin, Richard K. Steiner, and J. Mark Trach. It is announced that an attendance of 300 is expected. The meeting is being held in midsummer, and at a resort hotel, and elaborate provision is being made for outdoor entertainment in addition to the scientific program.

Charles H. Tweed Foundation for Orthodontic Research

The Charles H. Tweed Foundation for Orthodontic Research announces that it has allocated the sum of $2,000.00 per year for the next five years, the funds to be made available for research in basic and applied sciences. Application for these funds, with information concerning the projects for which the funds would be used, should be mailed to Ben L. Herzberg, Secretary, 7200 Exchange Ave., Chicago 49, Illinois.

Northwestern University Dental School

On June 4, 5, and 6, 1956, the Graduate Department of Orthodontics, Northwestern University Dental School, will present an advanced course on cephalometric radiography for the practicing orthodontist. The prerequisite for this course is the basic cephalometric radiography course presented at Northwestern University, or comparable training and experience.

For further information, write to the Director of Postgraduate Study, Northwestern University Dental School, 311 E. Chicago Ave., Chicago 11, Illinois.

Northwestern University Cleft Lip and Palate Institute

The Orthodontic Department of Northwestern University Cleft Lip and Palate Institute has been awarded a United States Public Health Grant of almost $14,000.00 to carry on studies of growth and development in relation to orthodontics and the cleft palate problem.

Dr. T. M. Graber, associate professor of orthodontics, is in charge of the department.

Dr. Wilton M. Krogman Honored

Dr. Wilton M. Krogman, recipient of many professional awards and honors and recognized nationally as an outstanding physical anthropologist, received another honor on Oct. 5, 1955, when he had conferred on him the honorary degree of Doctor of Laws by Baylor University, Dallas, Texas. The occasion was Baylor University's commemoration of the fiftieth anniversary of the College of Dentistry.

Dr. Krogman was cited as "an outstanding teacher and investigator in the study of child growth and development, a leader in the application of physical anthropology to problems of identification and criminology, an author of more than 100 publications in the field of anthropology."

Cuban Association of Orthodontists

The Cuban Association of Orthodontists held a meeting under the leadership of President Federico R. de la Rosa, on Feb. 21 and 22, 1956, at the University of Havana.

The program was dedicated to the dentists and physicians who have contributed much to the advancement of orthodontics.

Twelfth International Dental Congress of the Fédération Dentaire Internationale

The Twelfth International Dental Congress of the Fédération Dentaire Internationale will be held in Rome, Italy, Sept. 7 to 14, 1957.

For information, write Dr. Pio Lalli, Segretario Generale del Congresso, Via Boezio, 16, Rome, Italy, or Dr. Obed H. Moen, National Treasurer of F.D.I., 6 Main St., Watertown, Wisconsin.

Denver Summer Seminar

The Board of Trustees of the Denver Seminar have arranged the following program for the nineteenth annual meeting to be held in Denver at the Brown Palace Hotel, July 29 to Aug. 3, 1956:

BERTRUM S. KRAUS, PH.D., Associate Professor of Physical Anthropology, University of Arizona.

Subject:

The Course of Human Evolution as Plotted by the Palaeontological Landmarks.
The Roles of Heredity and Environment in Human Evolution.
The Evidence for the Inheritance of Dental Characteristics.
Gene Action and Inter-Action: Some Theoretical Considerations of Physiological and Developmental Genetics With Respect to the Dentition.
Pleiotroph, Mutations, and the Future for Man.

MARION MARESH, M.D., Roentgenologist for the Child Research Council of Denver and Associate Professor in the Department for the Study of Human Growth in the University of Colorado School of Medicine.

Subject:

Variations in Patterns of Growth.

HAROLD J. NOYES, D.D.S., M.D., Dean and Professor of Dentistry, the Dental School of the University of Oregon.

Subject:

The Role of Growth, Development and Function in Orthodontic Treatment.

EARL E. SHEPARD, D.D.S., Professor of Orthodontics, Washington University School of Dentistry.

LEO B. LUNDERGAN, D.D.S., Assistant Professor of Orthodontics, Washington University School of Dentistry.

Subject:

The Twin Wire Appliance, Its Fabrication and Method of Treatment.

Hotel reservations should be made directly with Mr. Karl W. Mehlman, Assistant to the General Manager, Brown Palace Hotel, Denver, Colorado. It is the opinion of the Board of Trustees that the Brown Palace Hotel will afford the finest of accommodations, as it is air conditioned and has a variety of eating places with excellent food. Please mention the Denver Summer Seminar, as a block of rooms are reserved for this group.

A printed program will be mailed at a later date.

Attendance is limited. Applications will be given preference in the order of their return.

H. Carlyle Pollock, Jr., Secretary.

Eastman Dental Dispensary

The Eastman Dental Dispensary in Rochester, New York, announces a postgraduate course in orthodontics. The course, beginning in September, will be eighteen months to two years in duration. Candidates for an advanced degree in dentistry must enroll in the two-year program; supplementary course work will be offered at the University of Rochester, School of Medicine and Dentistry.

Five graduate dentists will be accepted each September. Applications will be received up to June 1.

Further information and application forms may be obtained from Basil G. Bibby, Director, Eastman Dental Dispensary, Rochester 3, New York.

University of Pennsylvania

The University of Pennsylvania announces a postgraduate course entitled "The Twin Wire Mechanism." The course, taught by Dr. Joseph E. Johnson, will be given June 4 to 8, 1956. It is an advanced course for dentists who are engaged in the practice of orthodontics. All applicants should be members of sectional societies of the American Association of Orthodontists or hold certificates from a recognized graduate course in orthodontics.

Death of Mrs. Harold Chapman

Mrs. Harold Chapman, 6 Upper Wimpole St., London, W. 1, England, died suddenly on March 26, 1956. She was well known throughout the orthodontic profession in the United States.

Notes of Interest

Dr. Jerold F. Ahlfs announces the removal of his office to the Professional Bldg., Sunrise Center, Fort Lauderdale, Florida, practice limited to orthodontics.

Dr. Bert Ballin announces the removal of his office to 110 Prospect St., Stamford, Connecticut, practice limited to orthodontics.

Richard H. Bowlin, D.D.S., announces the removal of his office to 510 State Central Bank Bldg., Keokuk, Iowa, practice limited to orthodontics.

Harry Faulkner, D.D.S., announces that Milo M. Stucky, D.D.S., M.S., is now associated with him in the practice of orthodontics, 3406 Fourth Ave., San Diego, California.

William C. French, D.D.S., announces the opening of his office in the Professional Building, Richmond, Virginia, practice limited to orthodontics.

Joseph K. Gold, D.M.D., and Ira D. Gilbert, D.D.S., announce that they have moved their office from the People's Savings Bank Bldg., to 193 Elm St., Holyoke, Massachusetts, practice limited to orthodontics.

Arnold J. Hirsch, D.D.S., announces the opening of his office for the practice of orthodontics at 352 Nassau St., Princeton, New Jersey.

Newton J. Kellackey, D.D.S., announces the opening of his office at 3160 West 210 St., Rocky River, Ohio, practice limited to orthodontics.

Samuel J. Lewis, D.D.S., announces the association of J. E. Kreager, D.D.S., in the exclusive practice of orthodontics at 2901 South Westnedge Ave., Kalamazoo, Michigan.

Francis D. Murphy, D.D.S., announces the opening of his office at 919 Federal Securities Bldg., Lincoln, Nebraska, practice limited to orthodontics.

Dr. Thermon B. Smith announces the removal of his office to 1122 West Capitol at Cross, Little Rock, Arkansas, practice limited to orthodontics.

Jerome M. Sorrel, D.M.D., announces the reopening of his offices at 263 West End Ave., New York, New York, practice limited to orthodontics.

Correction: The name of Dr. Russell E. Irish's associate is Andrew T. Panchura, instead of "Pauchura" as stated in the April issue.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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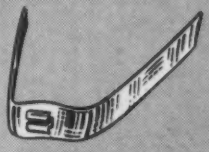

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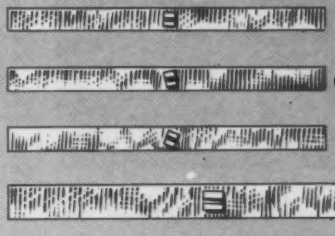

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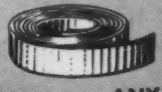

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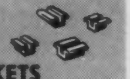

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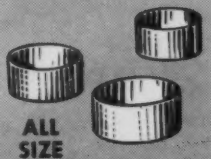

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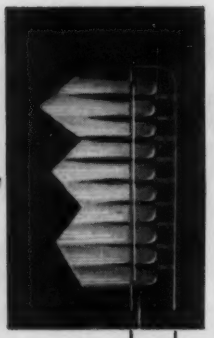

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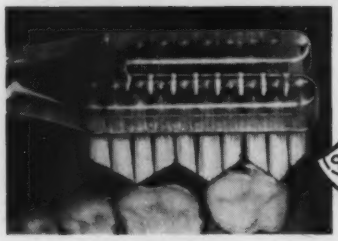

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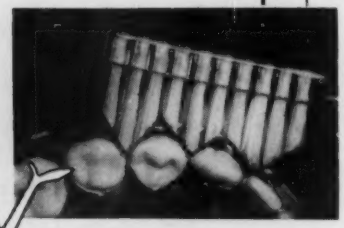

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